Research Portfolio

Junyoung Park

Researcher, UDNS Co., Ltd. · M.Eng., Chung-Ang University

Research Achievements



Junyoung Park

➢ Education — Chung-Ang University (CAU)

- M.Eng. 2022.03–2024.02 : CAU — Civil Eng. (Advisor: Prof. J.-W. Park) — GPA: 4.39/4.5
- B.S. 2017.03–2022.02 : CAU — Civil & Env. Eng.; Math (Double Major) — GPA: 4.2/4.5

Civil & Env. Eng. major GPA: 4.23/4.5
Mathematics major GPA: 4.18/4.5

➢ Career

- (2024.04–Present) UDNS Co., Ltd., R&D Researcher
- (2019.07–2024.02) CAU SITL, Researcher

➢ English Proficiency

– TOEFL 100 (C1): Reading 5.0, Listening 4.5, Writing 5.0, Speaking 5.0 (2026.02.28)

➢ Awards: 10

Event	Award	Date	Topic	Awarded by
KSMI 2023 Fall Conference	Excellent Paper Award	2024.04.04	Scalable IoT-Cloud Framework for Continuous Bridge Monitoring	KSMI
2022 Korea Future Talent Festival	Gold Prize	2022.11.25	IoT Smart Monitoring of Prefab Stability & Quality in Transit	NRF
2021 LINC+ Capstone Design Award	Excellence Award	2021.12.28	Cloud-Based IoT Monitoring of 3D Bridge Bearing Displacement	CAU LINC+ Program
2021 LINC+ Capstone Design Award	Popularity Award	2021.12.28	Cloud-Based IoT Monitoring of 3D Bridge Bearing Displacement	CAU LINC+ Program
12th LH Land Development Tech. Contest	Excellence Award	2021.11.25	Citizen-Participatory Smart City via QR-Code Sensor Visualization	LH
Smart Constr. Challenge 2021 (IoT·AI·Sensing)	KNR Chairman's Award	2021.11.17	IoT & Cloud-Based Continuous Bridge Displacement Monitoring	MOLIT
8th Univ. Water Env. Policy & Tech. Contest	K-eco Chairman's Award	2021.10.12	IoT & Deep Learning Smart Water Grid: Sewer and Water Mains	Ministry of Environment
2020 CAU Engineering Academic Fair	Dean's Award	2020.12.10	IoT Sensor-Based Bridge Maintenance System	CAU College of Eng.
3rd X-Corps Festival	Honorable Mention	2019.11.29	Integrated Temporary-Works Safety Monitoring via Smart Sensors & IoT	CAU Ctr. for Eng. Education
2019 Smart Earthquake Response Idea Contest	Minister's Award	2019.07.25	Earthquake Alert via Multisensory Media & Smart Sensors	MOIS

Research Achievements

➢ Journal Papers: 13 (SCI: 8, Non-SCI: 5; Under Review: 1)

Type	Year	Title	Journal	Authors
SCI (Under Review)	2027	Development of a Portable Multimetric Sensing System for Bridge Load Testing and Load-Carrying Capacity Evaluation	Measurement	J. Park, J. Shin, J. Won
SCI	2026	Low-Power Multi-Channel Strain Sensing and QR-Enabled Shape Visualization for Digital-Twin-Enabled Structural Health Monitoring	Journal of Civil Structural Health Monitoring	S. Khan, J. Park, J. Park, I. Kim, J. Won
	2024	Development of AI-Based Multisensory System for Monitoring Quay Wall Events	Journal of Marine Science and Engineering	J. Shin, J. Park, J. Won, J. Park, J. Min
	2023	Tendon Stress Estimation from Strain Data of a Bridge Girder Using Machine Learning-Based Surrogate Model	Sensors	SU Khayam, A Ajmal, J Park, IH Kim, JW Park
	2023	Monitoring Precast Structures during Transportation Using a Portable Sensing System	Automation in Construction	S.U. Khayam, J. Won, J. Shin, J. Park, J.W. Park
	2021	Development of low-cost wireless sensing system for smart ultra-high performance concrete	Sensors	H.V. Le, T. Kim, S. Khan, J. Park, J. Park, S. Kim, Y. Jang, D. Kim
	2021	Development of a reference-free indirect bridge displacement sensing system	Sensors	J. Won, J.W. Park, J. Park, J. Shin, M. Park
	2021	SSVM: An ultra-low-power strain sensing and visualization module for long-term structural health monitoring	Sensors	S. Khan, J. Won, J. Shin, J. Park, J. Park, S. Kim, D. Kim
	2020	BLESeis: Low-Cost IoT Sensor for Smart Earthquake Detection and Notification	Sensors	J. Won, J. Park, J.W. Park, I. Kim
Non-SCI	2026	Performance Comparison of Cloud and Local LLMs in a Hybrid Question-Answering System for WIM Operational Data Retrieval	KSCE J. Civ. Environ. Eng. Res.	J. Park, Y. Jho, J. Kim
	2026	Analysis of Freight Vehicle Operation Restriction Violations and Improvement of Enforcement Systems Based on Real-Road Data (in Korean)	J. Korea Inst. Intell. Transp. Syst.	Y. Kim, H. Jeong, J. Park, Y. Lee, Y. Jung, J. Kim, I. Yun
	2026	YOLO-based Automatic Axle Event Detection for High-Speed Weigh-In-Motion Systems	KSCE J. Civ. Environ. Eng. Res.	J. Park, J. Kim, Y. Jho, Y. Jung
	2024	Stabilization of Dynamic Weight Estimation Systems for Commercial Vehicles during Driving	J. Korean Soc. Mech. Aviat. Technol.	J. Park, J. Kim, J. Kim, Y. Jho
	2021	Development of Low-Power IoT Sensor and Cloud-Based Data Fusion Displacement Estimation Method for Ambient Bridge Monitoring	J. Comput. Struct. Eng. Inst. Korea	J. Park, J. Shin, J. Won, J.W. Park, M. Park

✓ Google Scholar: https://scholar.google.com/citations?hl=en&user=Y00UTgQAAAAJ

Research Achievements

➢ Conference Papers: 10 (International: 3, Domestic: 7)

Type	Date	Title	Organizer	Authors
International	2027.05	(Accepted) Cross-Analysis of WIM and OBM Signals for Weigh-in-Motion Calibration	ICWIM-10/HVTT-19	J. Park, M. Song, Y. Jho, J. Kim, T. Kim
	2023.08.23	Cloud-based Ambient Bridge Monitoring using Strain and Acceleration Measurements	KIBIM	J. Park, J. Shin, J.W. Park
	2022.11.18	Development of IoT Sensor and Cloud-based Server for Cloud-based Bridge Long-term Monitoring	KICEM	J. Park, J. Shin, J.W. Park
Domestic	2026.10.22	Real-Road Validation and Evaluation of AI-WIM Detection of Suspected Overweight Vehicles at Speed (in Korean)	KSCE	J. Park, J. Kim
	2025.11.14	Development of a Cloud-Based Integrated Platform for Automated Enforcement (in Korean)	KSCE	J. Park, J. Kim, J. Kim
	2023.10.12	Scalable IoT-Cloud Framework for Continuous Bridge Monitoring (in Korean)	KSMI	J. Park, J. Shin, J.W. Park
	2023.09.18	Long-Term Bridge Monitoring Based on IoT Sensors and Cloud Computing (in Korean)	KIBSE	J. Park
	2022.06.30	Cloud-Based IoT Sensor System for Bridge Load-Carrying Capacity Evaluation (in Korean)	KSPHM	J.W. Park, J. Park, J. Shin, J. Won
	2022.05.26	Optimizing Acceleration-Strain Displacement Estimation for Bridge Boundary Conditions (in Korean)	KSNVE	J. Park, J. Shin, J.W. Park
	2021.04.08	Cloud-Based Bridge Displacement Monitoring System (in Korean)	COSEIK	J. Park, J. Shin, J. Won, J.W. Park, M. Park

➢ Korean Patents: 11 (Registered: 7, Filed: 4)

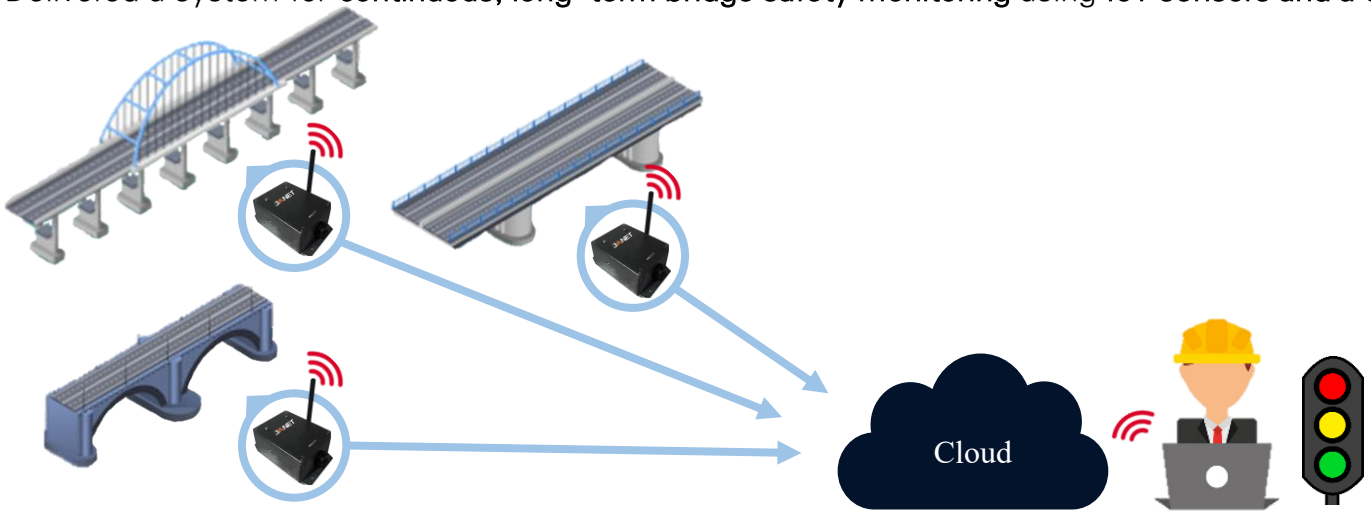
Status	Reg./App. No.	Title of Invention	Inventors
Filed	10-2026-0199549	Method and Apparatus for Estimating Combined-Container Weight Using On-Board Scales and Weigh Stations	J. Kim, Y. Jho, J. Park, M. Song
Filed	10-2026-0209028	Method and Apparatus for Vehicle Recognition Using a LiDAR Sensor	J. Kim, Y. Jho, Y. Jung, J. Park
Filed	10-2026-0101228	Heterogeneous Sensor-Based Vehicle Dimension Measurement System for Screening Oversized Vehicles	J. Kim, Y. Jho, Y. Jung, J. Park
Filed	10-2026-0218117	System and Method for Continuous Bridge Load-Carrying Capacity Evaluation Using HS-WIM	J. Kim, Y. Jho, J. Park
Registered	10-2951213	Method and Apparatus for Real-Time FIR Filter-Based Correction of Dynamic Truck Operating Weight	J. Kim, Y. Jho, J. Park
Registered	10-2853678	System and Method for Automatic Recognition of Loading Intervals Using IoT Sensors for Load-Carrying Capacity Evaluation	J.W. Park, J. Park, J. Shin
Registered	10-2892584	Concrete Crack Trajectory Monitoring Device Using a Resistive Touchpad and Long-Term Measurement History Visualization System	J.W. Park, K. Kim, J. Park
Registered	10-2558124	IoT Sensor-Based Integrated Monitoring System and Method for Precast Member Transportation	J.W. Park, J. Park, J. Shin, J. Lee
Registered	10-2705761	Cloud-Based Smart IoT Sensor Data Preprocessing for Structural Monitoring and Deep Learning-Based Automated Anomaly Detection System	J.W. Park, J. Won, J. Park, J. Shin
Registered	10-2389222	Citizen-Participatory Smart City System via Sensor Measurement and Data Visualization	S. Park, J. Shin, J. Park
Registered	10-2353297	Smart IoT Earthquake Sensor Unit and Notification Method Using the Same	J.W. Park, J. Park

Research Projects

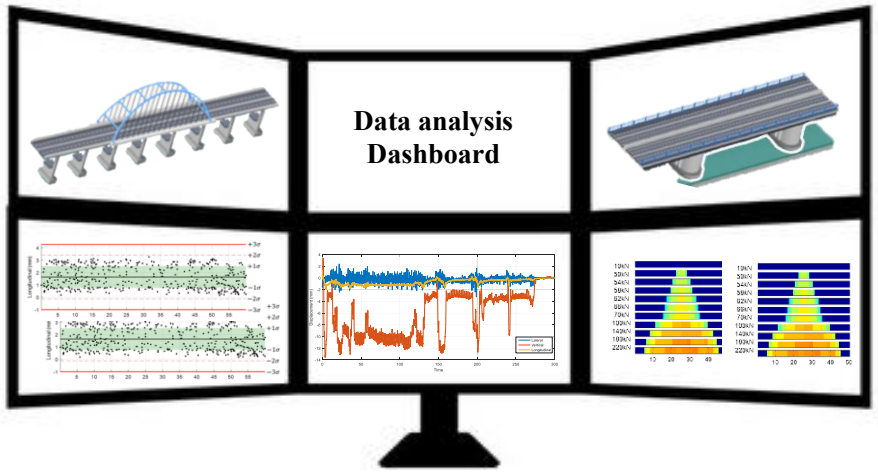
Research Projects (1)

Project ①: Development of IoT Sensing and Cloud System for Smart Bridge Level 3 (MOLIT, 2021.04–2022.12)

- Targeted the limits of detailed safety inspections: labor-intensive load-carrying capacity evaluation cannot keep pace with a **shrinking construction workforce** and **aging bridges**, and 6-month to 2-year inspection intervals delay response to emerging problems
- Developed stand-alone **smart sensors** needing no separate power or communication unit to **measure acceleration and strain**, key bridge safety indicators, and **built a cloud server** for unmanned, automatic data collection; **embedded a DB and built-in algorithms in the cloud** to automate computations such as **FFT and displacement estimation**
- Delivered a system for **continuous, long-term bridge safety monitoring** using **IoT sensors and a cloud system**



1. Smart Sensor



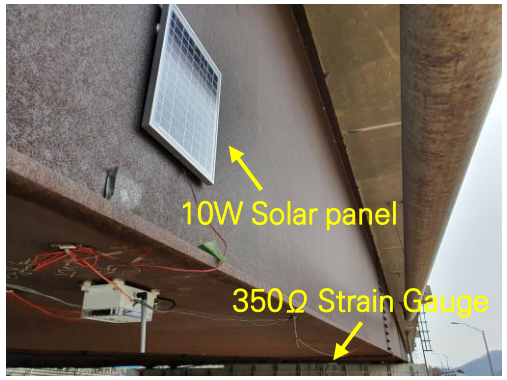
2. Cloud System

Research Projects (1)

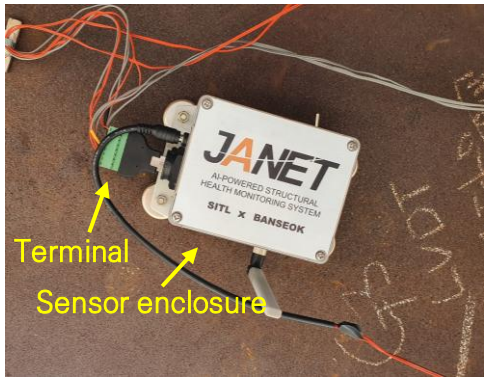
Project ①: Development of IoT Sensing and Cloud System for Smart Bridge Level 3 (MOLIT, 2021.04–2022.12)

- Field-deployed sensors on **Paldang Overpass (Gyeonggi)** and **Cheongdam 1 Bridge (Seoul)** for **long-term displacement monitoring**

[Paldang site view]

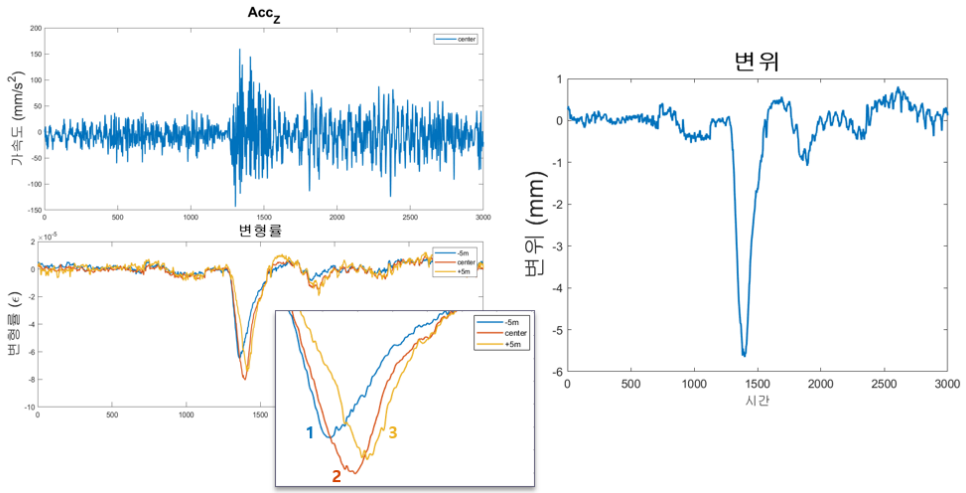


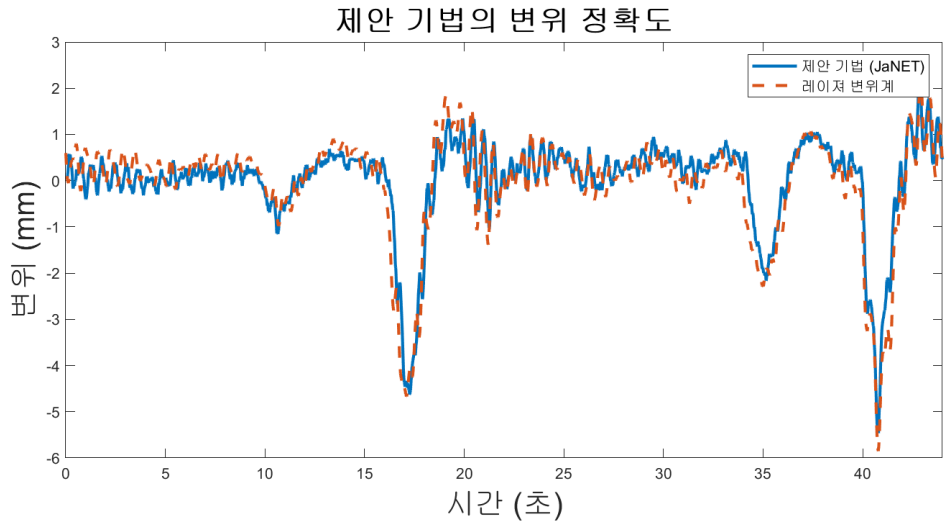






[Sensor data]





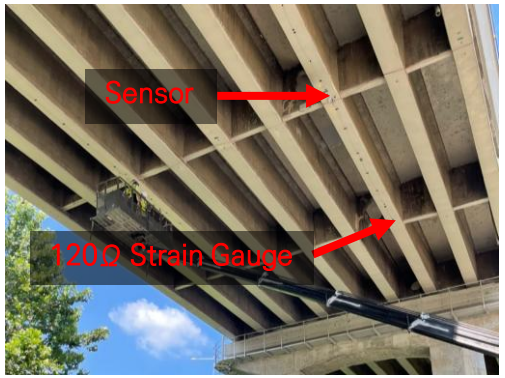
Research Projects (1)

Project ①: Development of IoT Sensing and Cloud System for Smart Bridge Level 3 (MOLIT, 2021.04–2022.12)

- Field-deployed sensors on **Paldang Overpass (Gyeonggi)** and **Cheongdam 1 Bridge (Seoul)** for **long-term displacement monitoring**

[Cheongdam 1 site view]

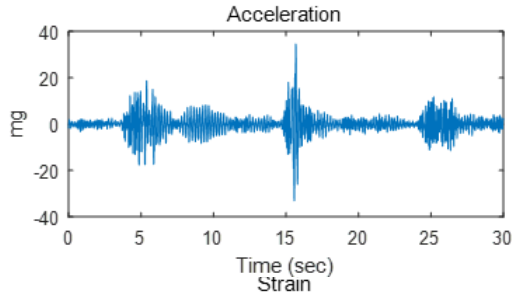


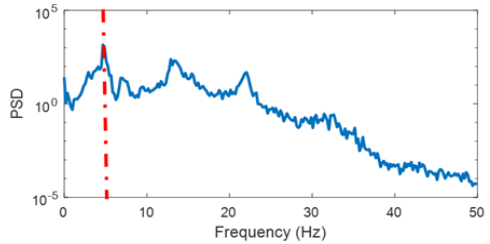


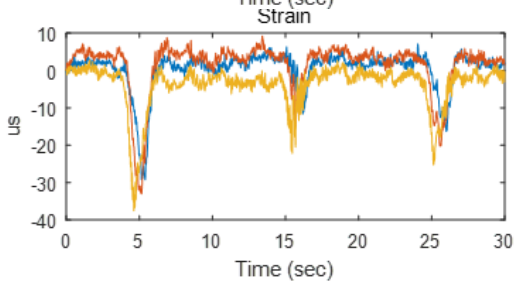


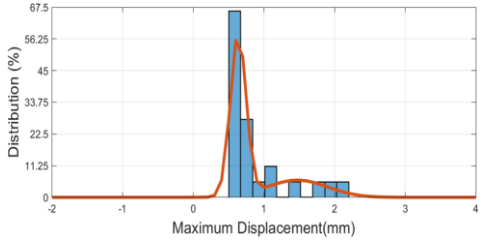


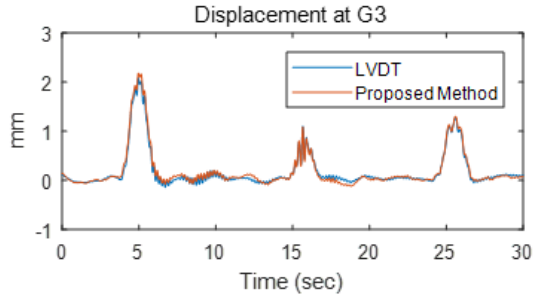
[Sensor data]











LVDT	JANET	Difference
2.08mm	2.18mm	0.1mm
1.01mm	1.09mm	0.08mm
1.26mm	1.31mm	0.05mm

Research Projects (1)

Project ①: Development of IoT Sensing and Cloud System for Smart Bridge Level 3 (MOLIT, 2021.04–2022.12)

- Applied the system to in-depth safety diagnoses of **10+ in-service bridges as of 2022** to identify and fix field issues **(20+ as of 2024)**
- Uncovered improvements invisible at lab scale and **updated the sensor circuit design (hardware) and software 5+ times** to enhance performance

1. Installation Efficiency

One sensor per quantity: cost grows with each quantity

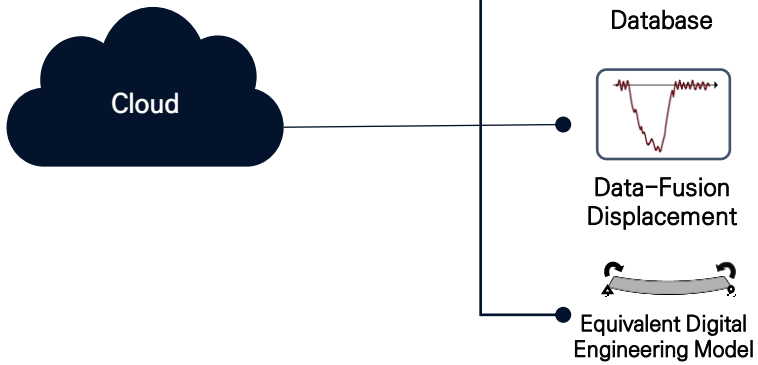
2. Power Supply

Power management for long-term use without battery replacement

3. Communication

Data loss, network faults, etc. Comm. error handling needed

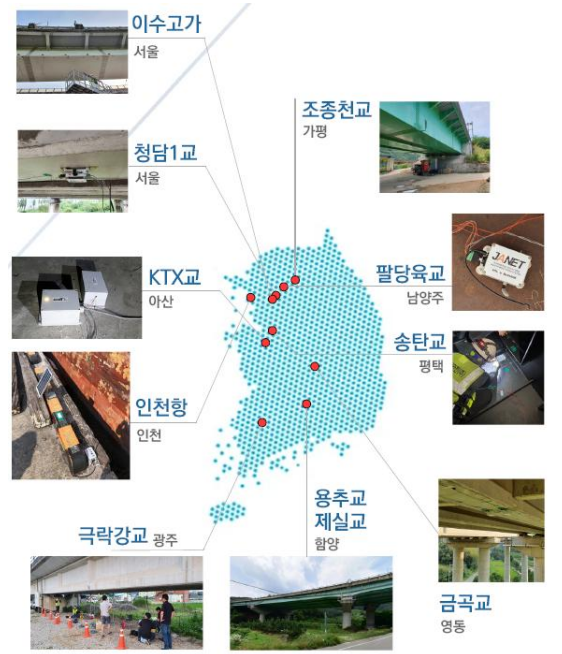




Natural Frequency from Measured Acceleration

Accel.-Strain Fusion Displacement Estimation

Equivalent Neutral Axis Damage Monitoring

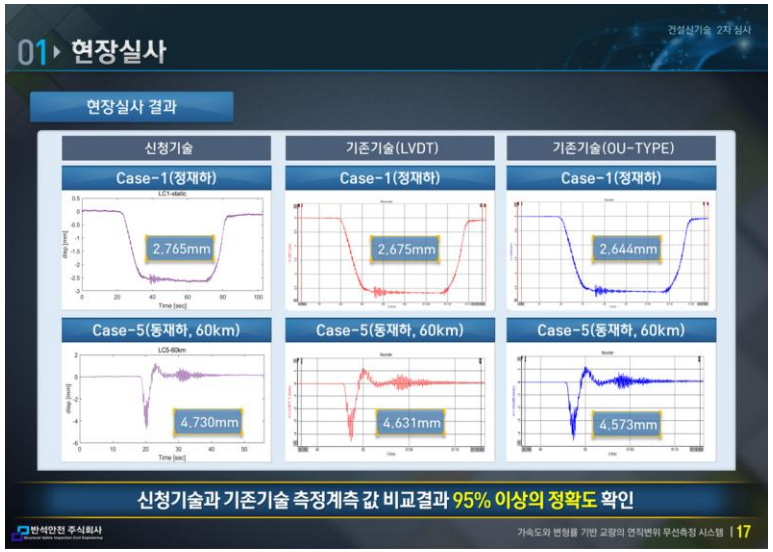


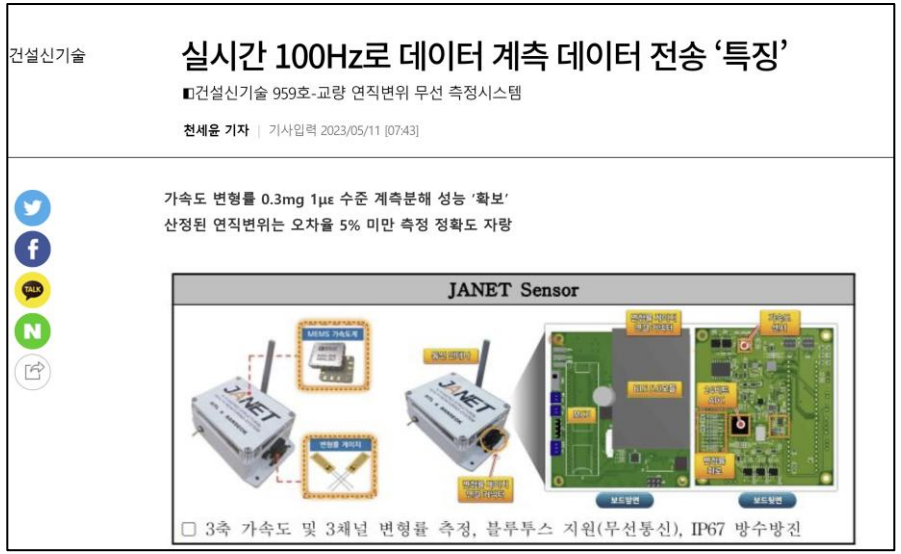
Research Projects (1)

Project ①: Development of IoT Sensing and Cloud System for Smart Bridge Level 3 (MOLIT, 2021.04–2022.12)

- Spent 1+ year after the project ended preparing the New Technology application so the **research outcomes** could be used in actual bridge safety diagnoses; the technology was designated **Korea Construction New Technology No. 959**
- Learned, from my first research proposal to its designation, **what processes and efforts academic technology needs to reach industry**



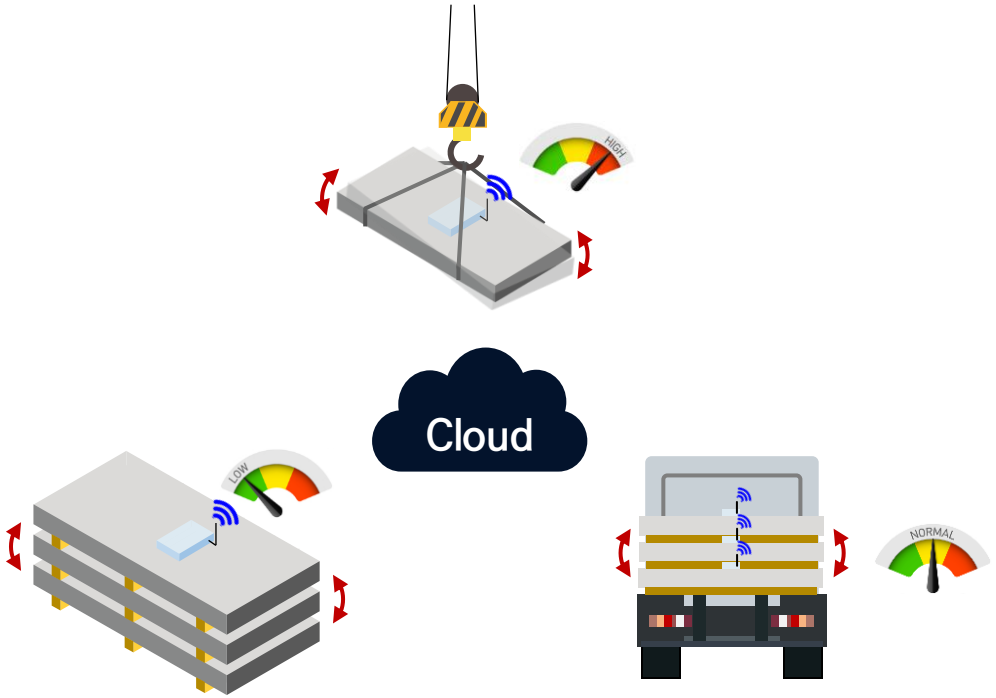


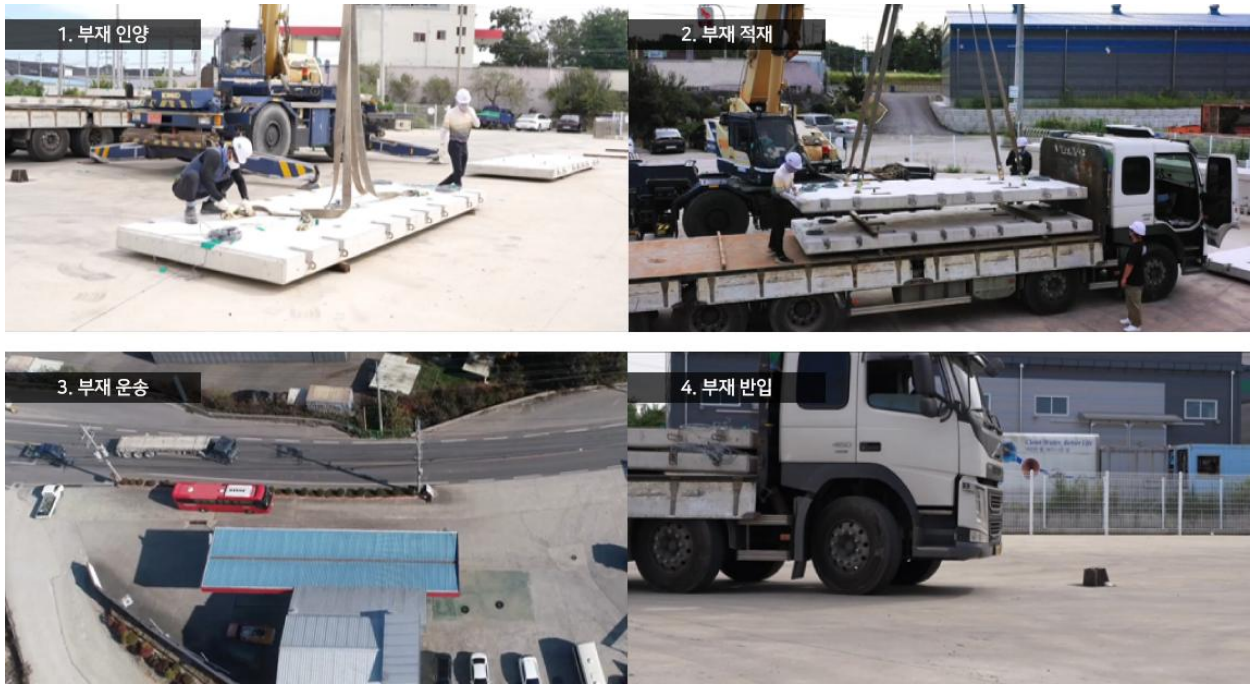


Research Projects (2)

Project ②: Intelligent Construction Quality Management for Road Structures (MOLIT, 2020.04–2023.12)

- Targeted a monitoring gap: contrary to the belief that factory-made members are safe, **prefab members can also crack or deform excessively in transport**, yet **no technology monitored members in transit**
- **Installed JANET on each member** to **collect acceleration and strain data** across all transport stages (lifting–loading–transport–delivery) and **assessed member safety** from the data



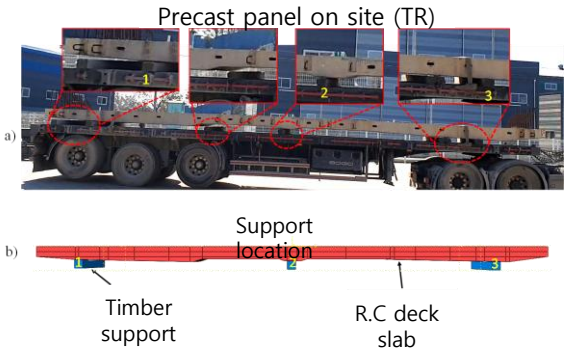


Research Projects (2)

Project ②: Intelligent Construction Quality Management for Road Structures (MOLIT, 2020.04–2023.12)

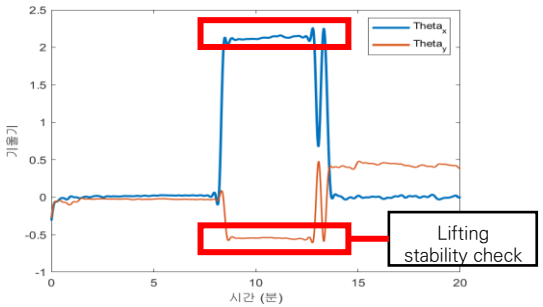
- Targeted safe transport: avoiding **excessive deformation or vibration** requires **timber supports at planned points and tight straps**
- **Analyzed tilt, vibration, and strain data** per transport stage to assess safety, **built an early-alert system for excessive anomalies**, and **designed its thresholds**
- Instrumented **real prefab members and ran test drives** with Bricon Co., Ltd. (prefab R&D plant) to collect and analyze data

[Test setup]

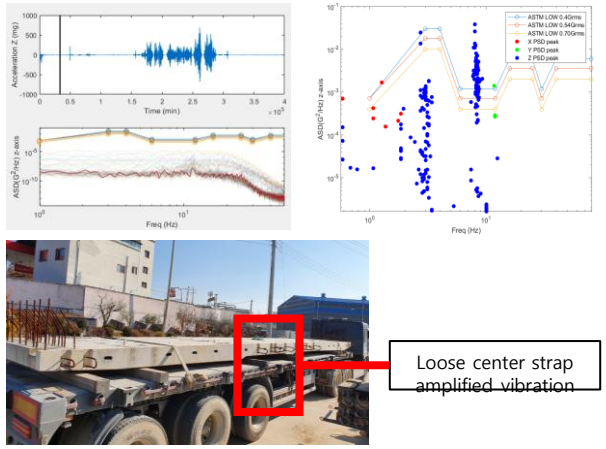


[Tilt assessment]

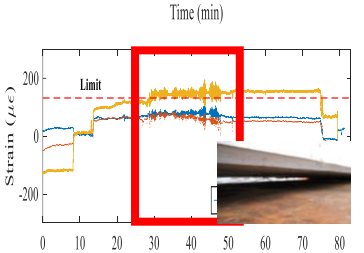




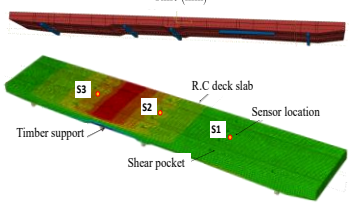
[Vibration (ASTM)]



[Crack assessment]



Max tensile strain in transit: 132.3 με, close to the ~~138 με tensile~~ limit



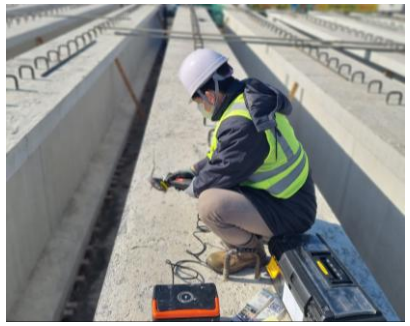
Weak zones and max-strain criteria via FEM

Research Projects (2)

Project ②: Intelligent Construction Quality Management for Road Structures (MOLIT, 2020.04–2023.12)

- Extended the scope from deck slabs **to concrete girders**, **monitoring them in transit** with JANET and analyzing real transport data

[JANET pre-installation]



Concrete surface leveled with a grinder



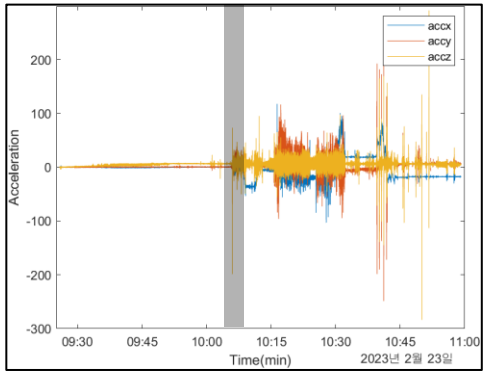
Strain gauges attached to the prepared surface



Adhesive applied at gauge spots
Steel plate attached for JANET



JANET terminal wired to 3-ch strain gauges



[Girder monitoring in transit]



① Lifting



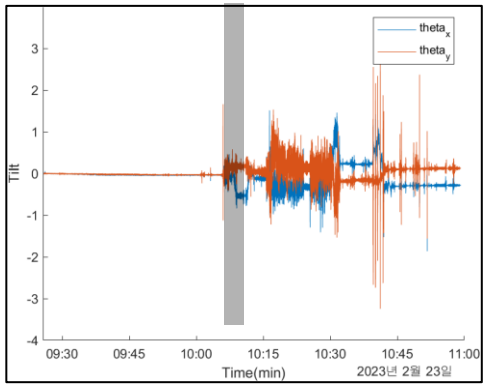
② Loading



③ Transport



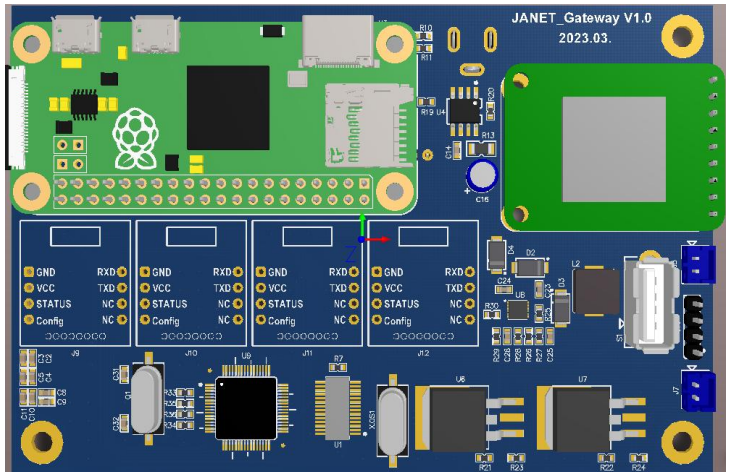
④ Erection



Research Projects (2)

Project ②: Intelligent Construction Quality Management for Road Structures (MOLIT, 2020.04–2023.12)

- **Designed the LTE-based JANET Gateway circuit** to visualize the transport status of prefab members remotely
- **Collected data from multiple JANET nodes in real time** (via Bluetooth) and, with an onboard **GPS module**, **streamed each node's data and transport status to the cloud server in real time**
- **Applied in 4+ field deployments in 2023**, fixing operational issues and **shortening sensor installation time** to **refine the process** for field use



JANET Gateway PCB Layout



Packaged JANET Gateway





Gateway on a trailer

Research Projects (3)

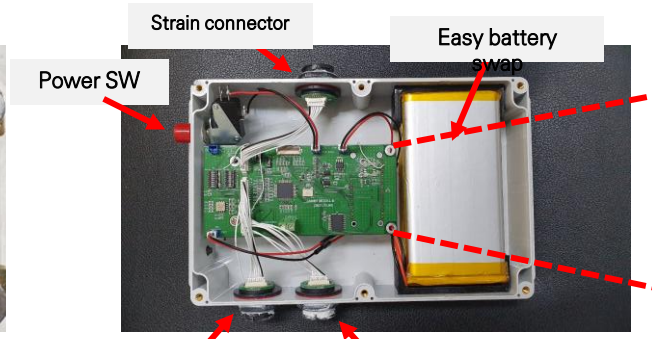
Project ③: Digital Design–Fabrication–Construction Support for Road Structures (MOLIT, 2020.04–2023.12)

- Addressed the need to **measure absolute (static) strain long-term** over **the full life cycle of prefab members**
- Designed an ultra-low-power circuit (**0.34 mA** in idle mode) to **run 10+ years** without battery change or charging; built a sensor **auto-triggered weekly** by an RTC for **multichannel strain measurement**, and **acquired data from real prefab members**
- **Displayed accumulated data as QR codes on E-paper** so that **data collection can later be automated** via drones or robot dogs

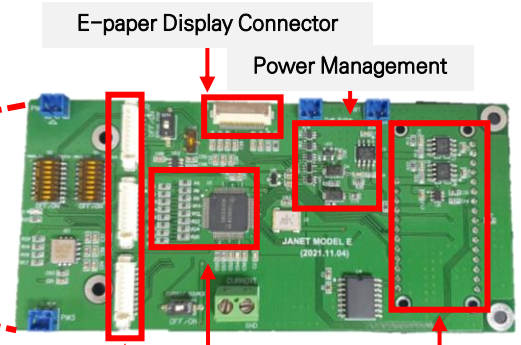




Logged data
80 records
QR display



8-ch strain
simultaneous

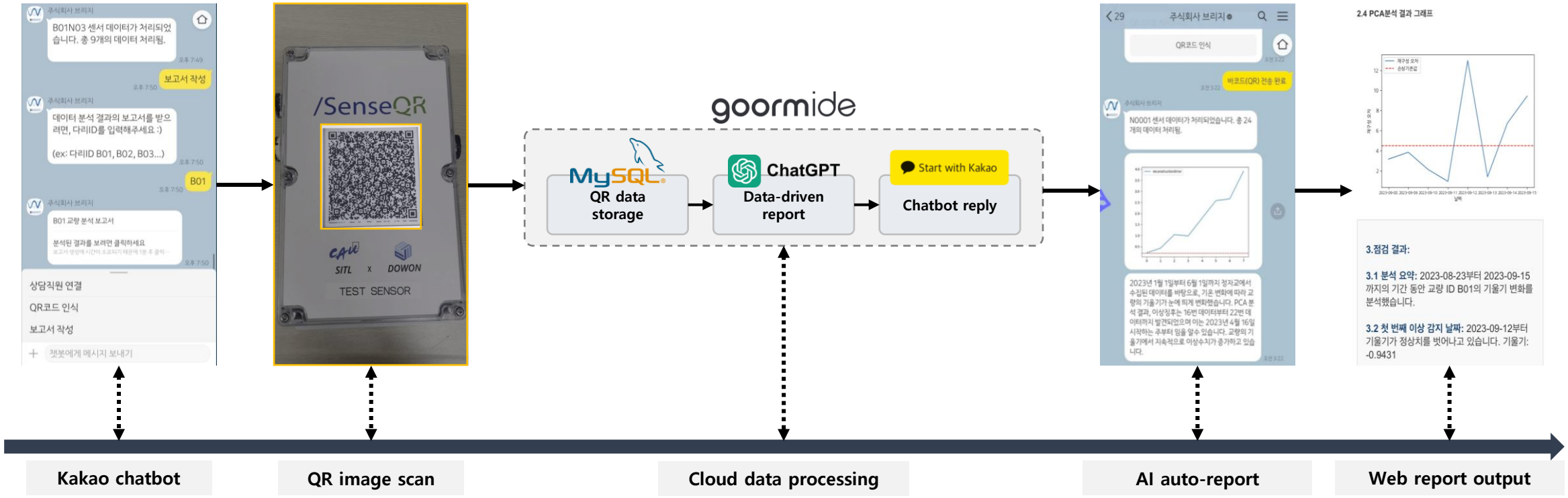


No charging
Runs 5+ yrs

Research Projects (3)

Project ③: Digital Design–Fabrication–Construction Support for Road Structures (MOLIT, 2020.04–2023.12)

- Designed a **data collection interface** on a **KakaoTalk chatbot** that needs no app development or installation, using **the phone's LTE link** so that **data reach the server without a communication module on the sensor**
- Developed a pipeline that decodes the QR code on the sensor, stores the data in a DB, and **generates instant data-driven reports** through **built-in GPT-based prompts**



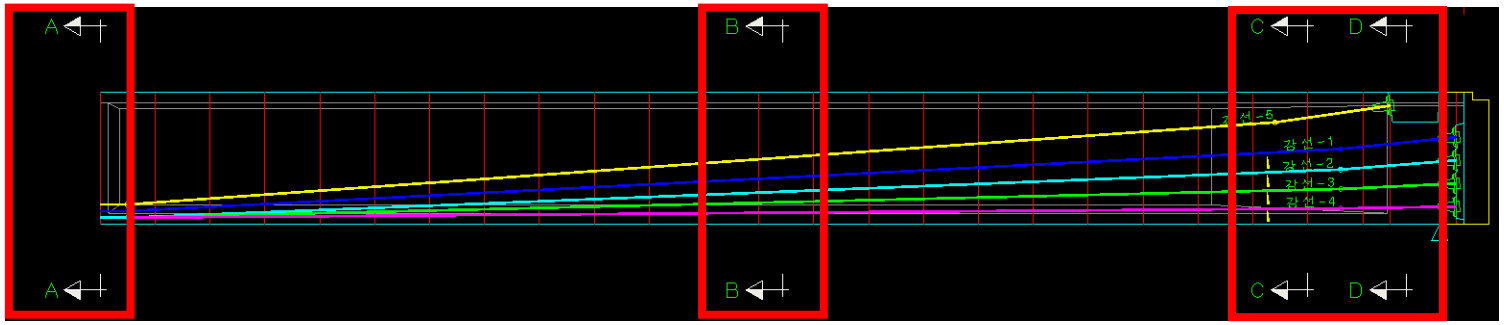
Research Projects (3)

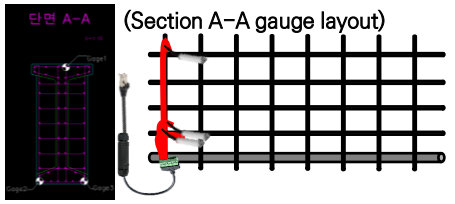
Project ③: Digital Design–Fabrication–Construction Support for Road Structures (MOLIT, 2020.04–2023.12)

- Installed **eight embedded strain gauges and a 1-channel thermometer** inside girders of **Chohacheon Bridge**, then under construction in Gyeonggi-do (2022.11–2023.07; sensors retrieved after completion), and collected data at regular intervals via QR sensors





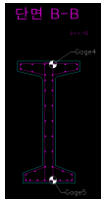




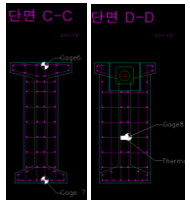
(Section A–A gauge layout)

Chohacheon Bridge
field installation





(Section B–B gauge layout)



(Sec. C–C, D–D gauge layout)

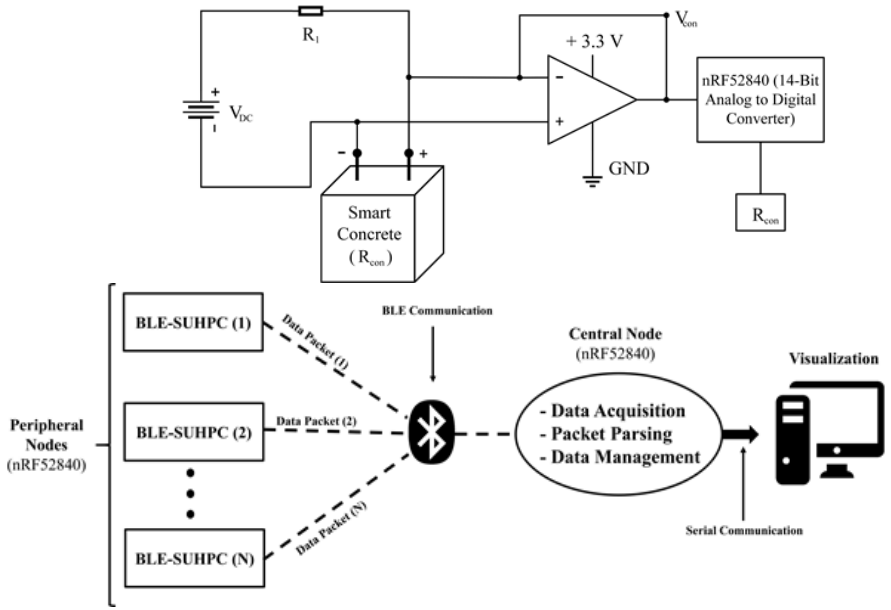


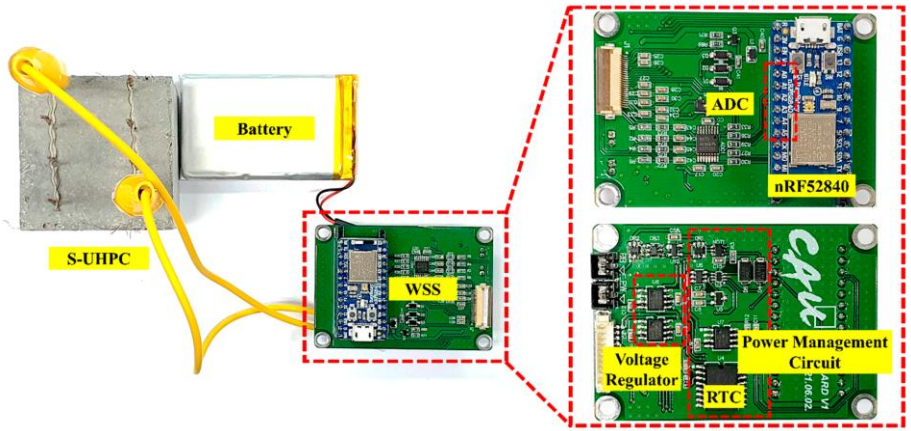


Research Projects (4)

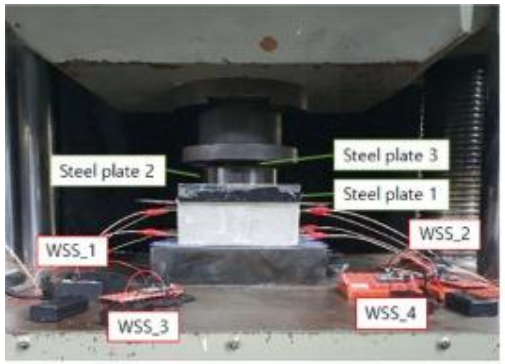
Project ④: Basic Research Lab for Bridge Condition Assessment Using Digital Twins (MSIT, 2019.09–2022.02)

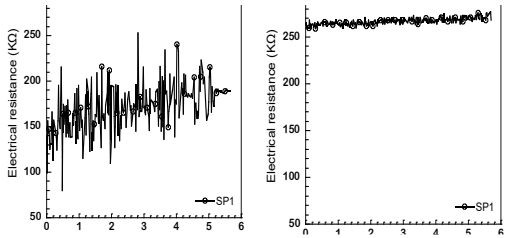
- Applied **smart concrete** between the structure and strand anchorages so its data can **properly sense structural stress**
- Built a system **measuring resistance change via voltage change** to relate tension/compression to voltage response
- Enabled **one master device to receive multichannel concrete sensor data** over **Bluetooth Low Energy beacons**, with data logged and visualized on a Python server
- **Varied power and electrode setups** and **applied a median filter** to minimize noise and impulses





Eddystone	Adv flags (3 Bytes)	Services (4 Bytes)	Length	Type	UUID	Eddystone Frame (20 Bytes)						
			(4 Bytes)									
iBeacon	Adv flags (3 Bytes)	Length (1 Bytes)	Type (1 Bytes)	Company ID (2 Bytes)	Beacon Type (2 Bytes)	Proximity UUID (16 Bytes)			Major (2 Bytes)	Minor (2 Bytes)	Power (1 Bytes)	
BLE-SUHPC	Adv flags (3 Bytes)	Length (1 Bytes)	Type (1 Bytes)	Sensor ID (2 Bytes)	Beacon Type (2 Bytes)	Latitude (8 Bytes)	Longitude (8 Bytes)		Rcon (2 Bytes)	Vcon (2 Bytes)	Power (1 Bytes)	





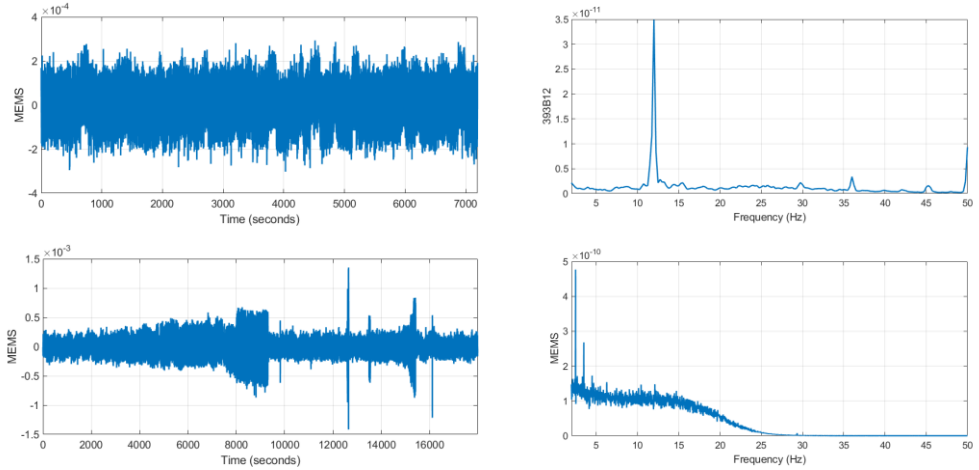
Research Projects (5)

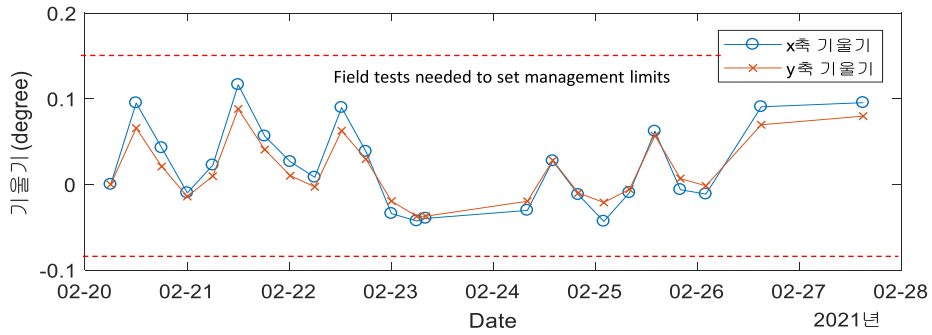
Project ⑤: Port Monitoring System Development (KICT contract, 2021.03–2023.11)

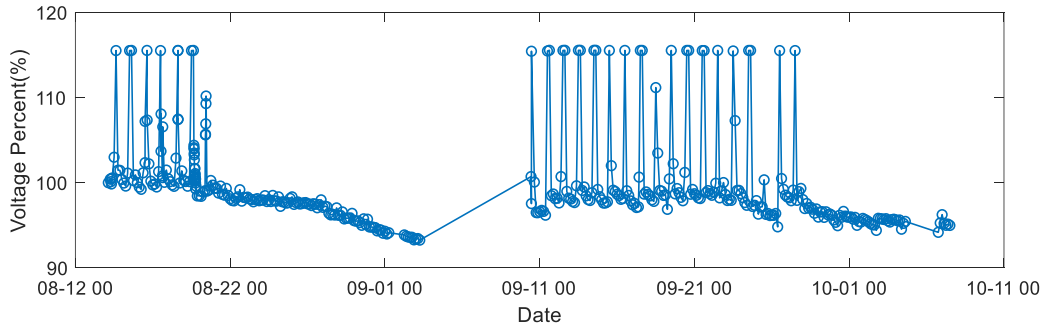
- Addressed the need for **sensing in extreme salt and operating conditions** to **monitor port facility behavior and condition**
- Packaged JANET in an **IP67 waterproof case** with **solar self-charging** to monitor **port tilt, vibration, and natural frequency changes**
- Transmitted data wirelessly to the cloud via a built-in LTE-M modem and added a **watchdog timer (WDT)** for **fault-tolerant operation**









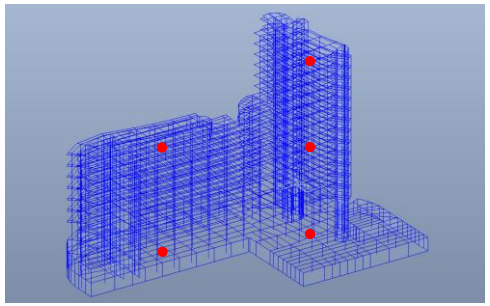


Research Projects (6)

Project ⑥: TCP/IP Sensor Framework for Building Ambient Vibration Monitoring (Soongsil Univ., 2022.03–2024.02)



[Hyungnam Eng. Bldg.]



[MIDAS model]

- Studied Soongsil Univ.'s Hyungnam Engineering Building, an **asymmetric structure** of **two connected RC buildings** (9 and 15 stories)
- Installed JANET at five locations to **analyze each building's dynamics**, collecting time-synced data over campus TCP/IP



[Node 1-1]



[Node 1-2]



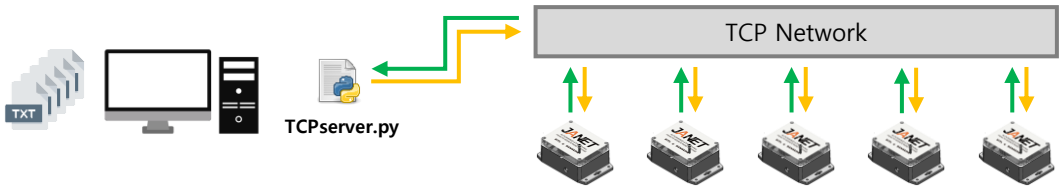
[Node 2-1]



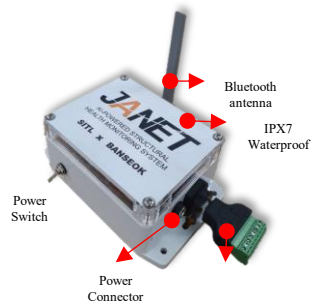
[Node 2-2]



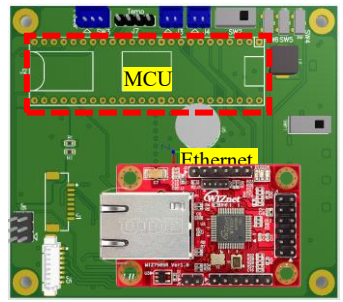
[Node 2-3]



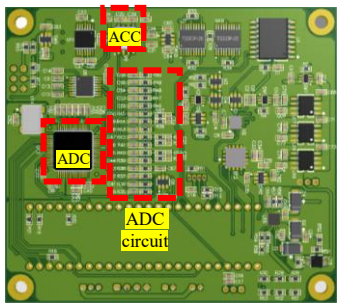
[TCP/IP network]



[IoT sensor JANET]



[Sensor front]



[Sensor back]

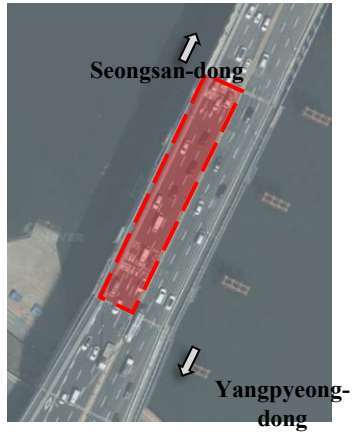
- Built a **Python multi-port TCP/IP data server**
- Auto-extracted **peak acceleration** and **FFT natural frequency** per 10 min via a Flask trigger
- Captured 3-axis acceleration **within 0.1 mg precision** at **a 100 Hz sampling rate** for precise analysis of structural dynamics
- Embedded an Ethernet modem (WIZ750sr) with **10/100 Mbps Ethernet / max. 230 kbps serial speed** to **stream 100 Hz 3-axis acceleration in real time** for building monitoring

Research Projects (7)

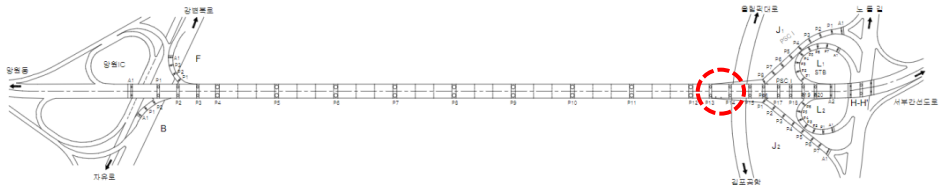
Project ⑦: Seongsan Bridge Inspection – Online Medium-Term Monitoring (Seoul City, 2023.01–2024.02)

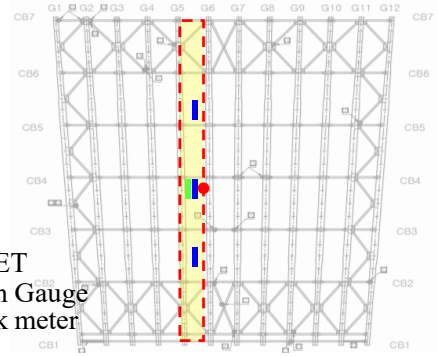
- Monitored **ambient vibration, strain, and displacement** and **deck vibration and cracks** with **JANET** at **both bridge ends**
- Stored sensor data in a **cloud DB** via an **LTE modem**, managed through a **web dashboard**



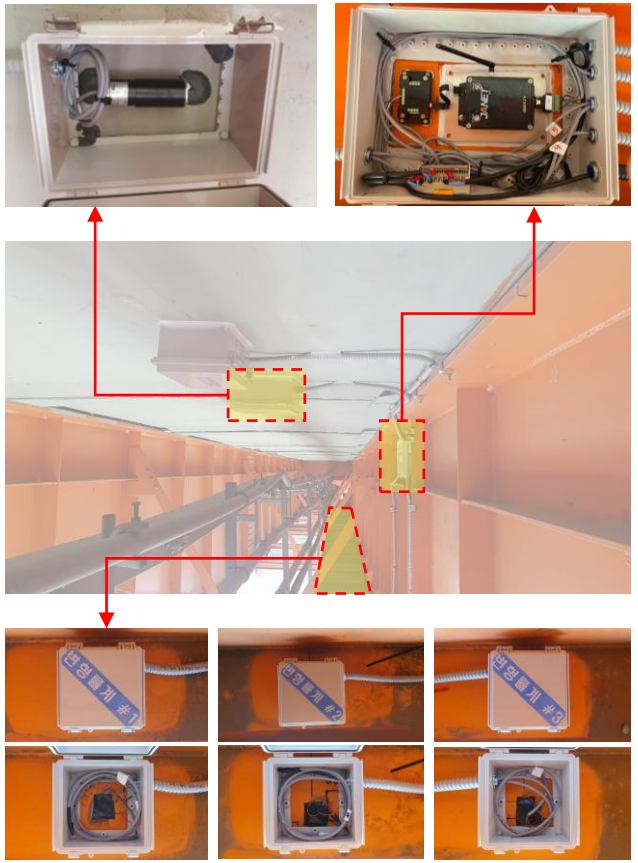








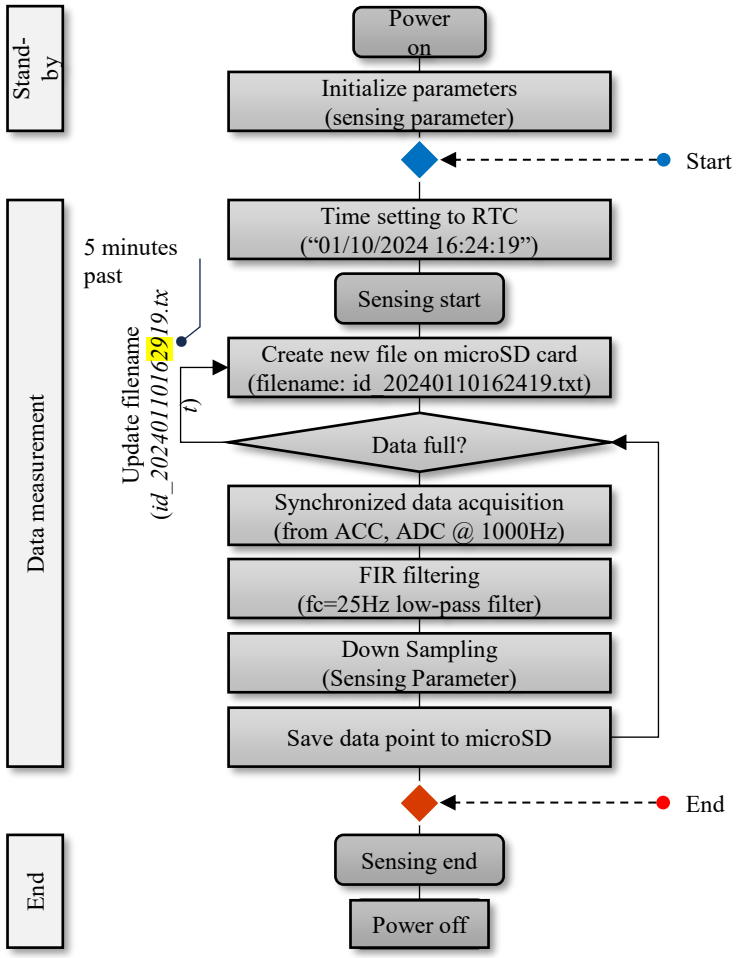
JANET
Strain Gauge
Crack meter

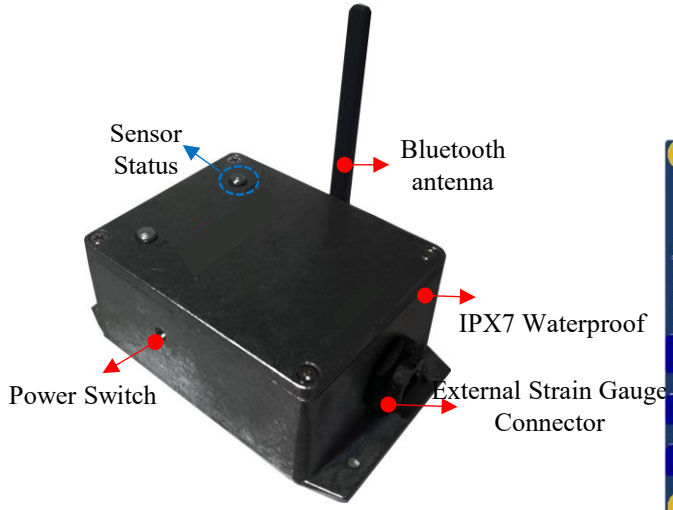


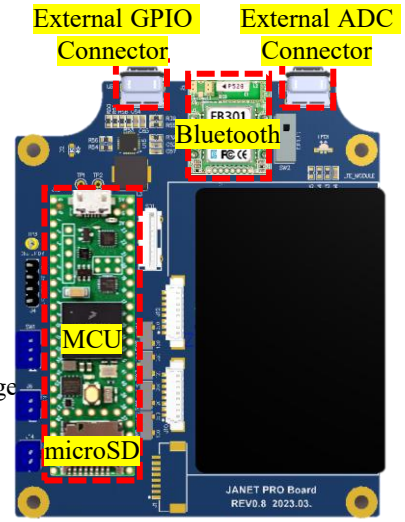
Research Projects (7)

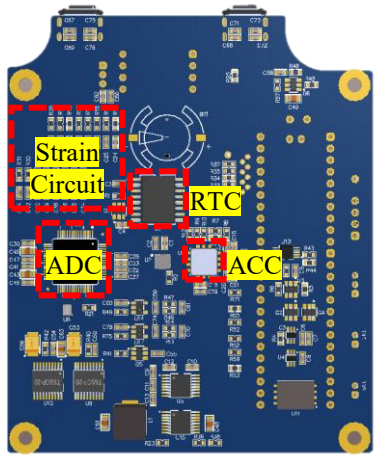
Project ⑦: Seongsan Bridge Inspection – Online Medium-Term Monitoring (Seoul City, 2023.01–2024.02)

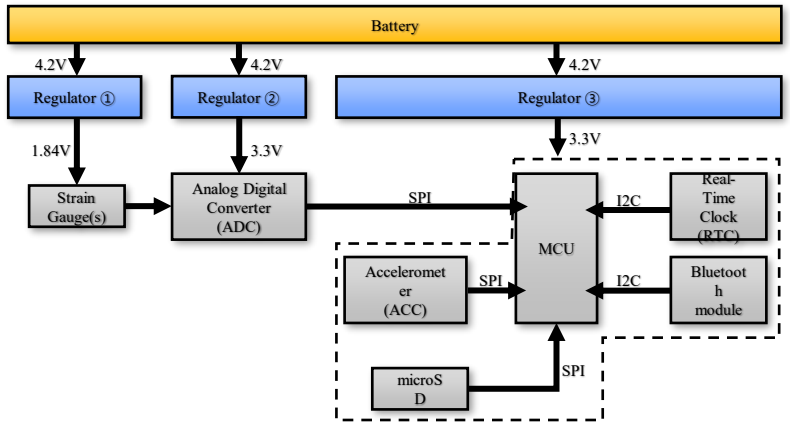
- Improved circuit stability and strengthened low-power design of the existing sensor, with a mass-producible PCB and a new enclosure
- Replaced the previous analog accelerometer with a digital accelerometer (ADXL355), expanding analog channels from 5 to 8

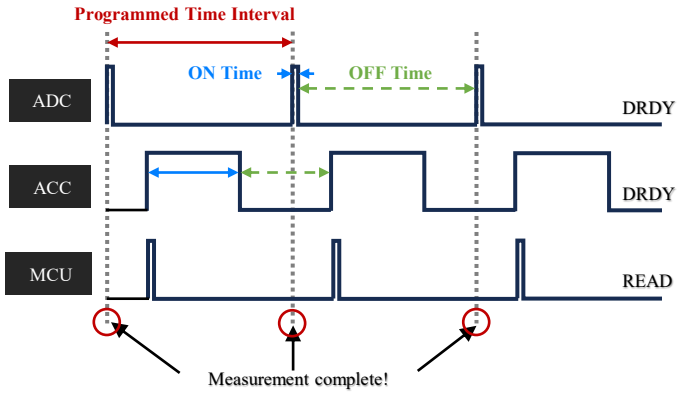








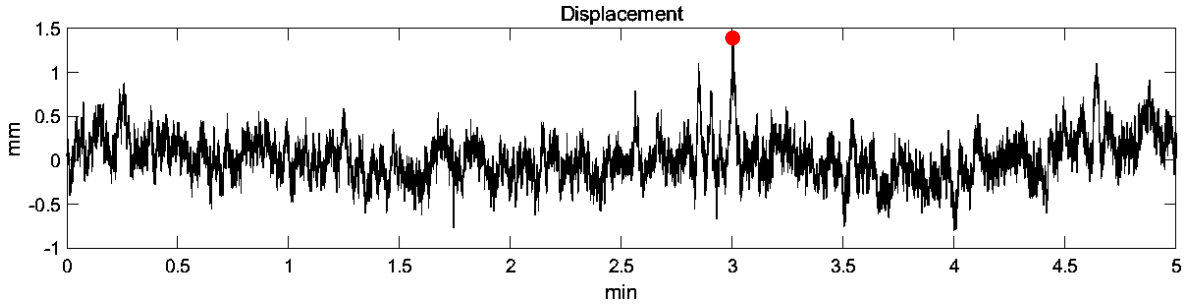


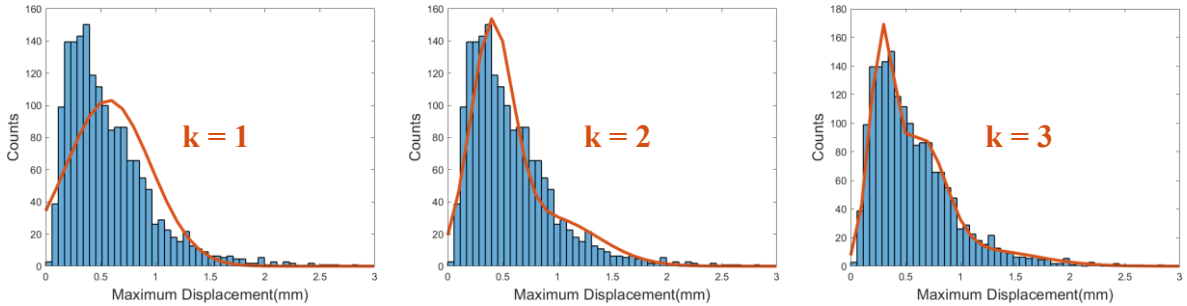


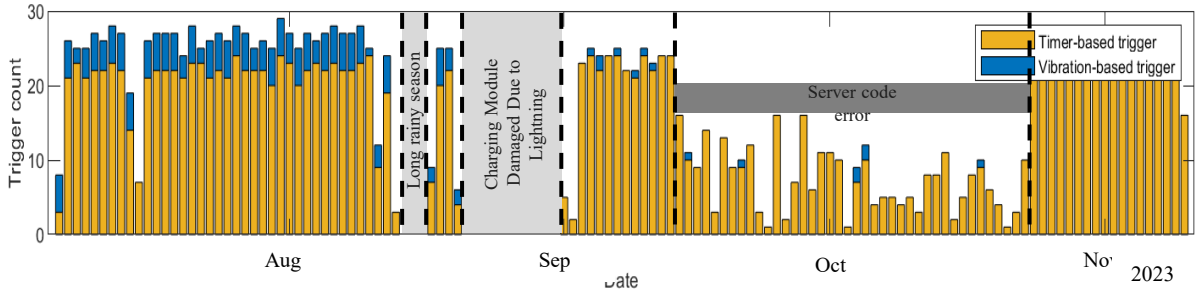
Research Projects (7)

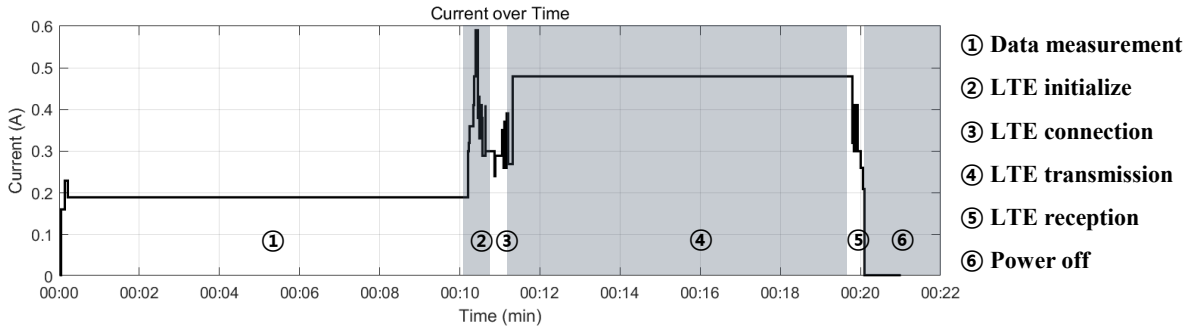
Project ⑦: Seongsan Bridge Inspection – Online Medium-Term Monitoring (Seoul City, 2023.01–2024.02)

- Analyzed displacement histories from long-term JANET monitoring of Seongsan Bridge, confirming that maximum displacements stayed within the allowable deflection (L/1000) on the safe side
- Improved the server code after data loss during operation and inspected the solar panels to raise system stability
- Also tracked long-term histories of natural frequency and crack-meter readings





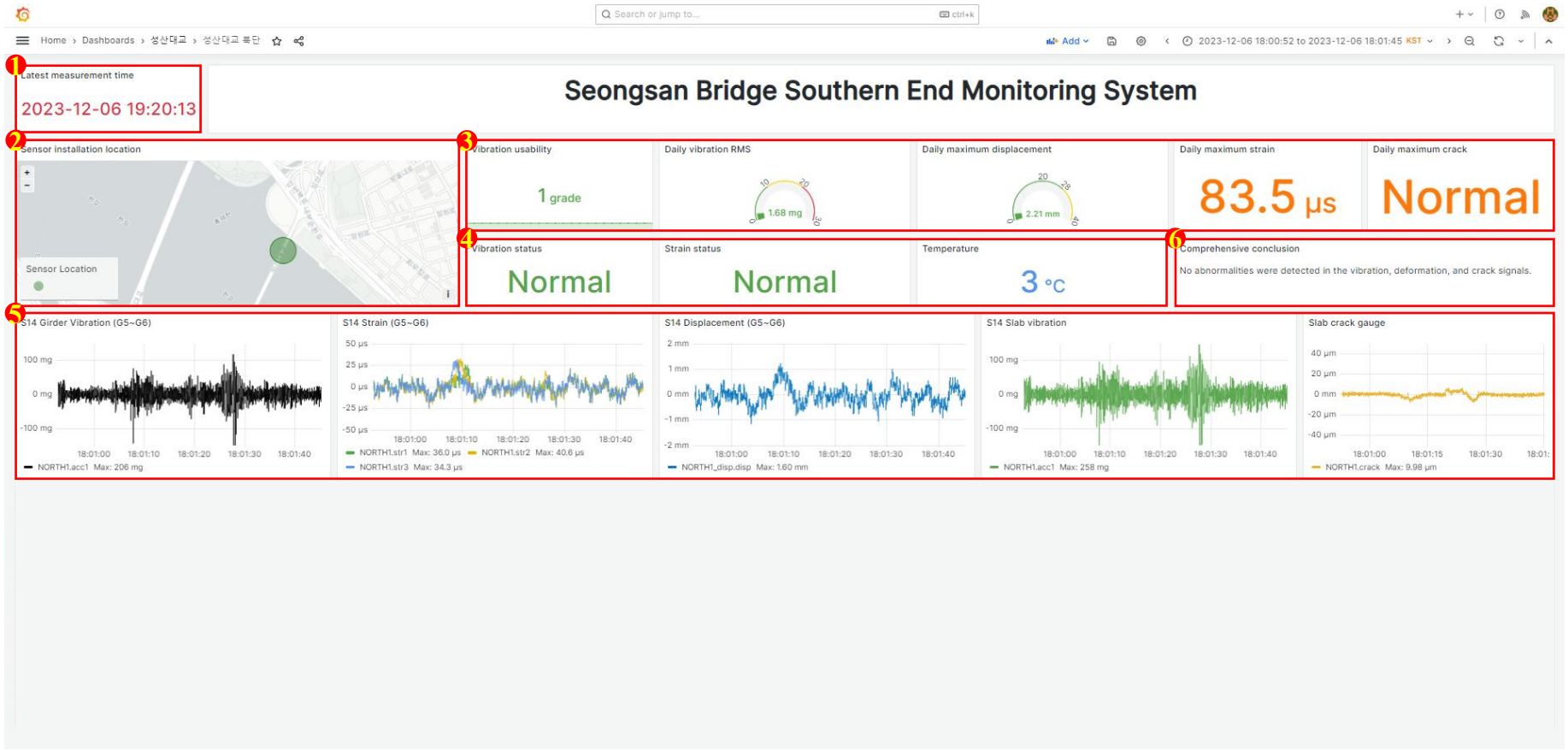




Research Projects (7)

Project ⑦: Seongsan Bridge Inspection – Online Medium-Term Monitoring (Seoul City, 2023.01–2024.02)

- Served a **web dashboard** reachable at the server address:port; its layout is shown below



① Last measurement time

② Sensor location

③ Vibration grade, RMS, displacement grade, strain status

④ Vib./strain/temp. status

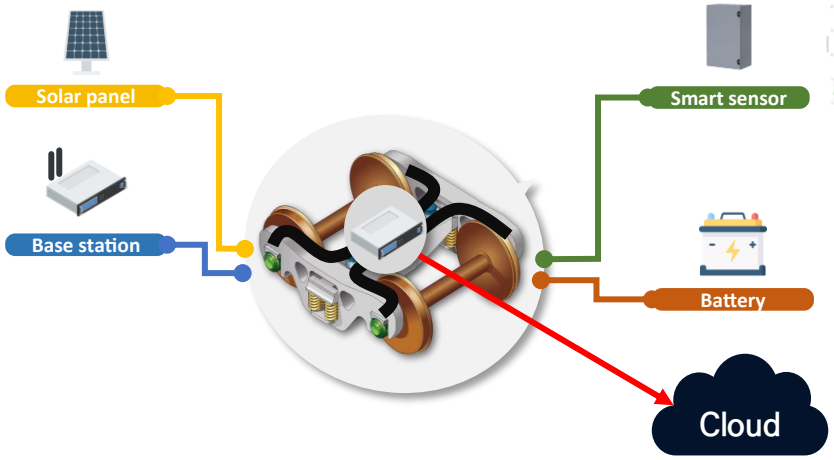
⑤ Time-series plots

⑥ ChatGPT overall comment

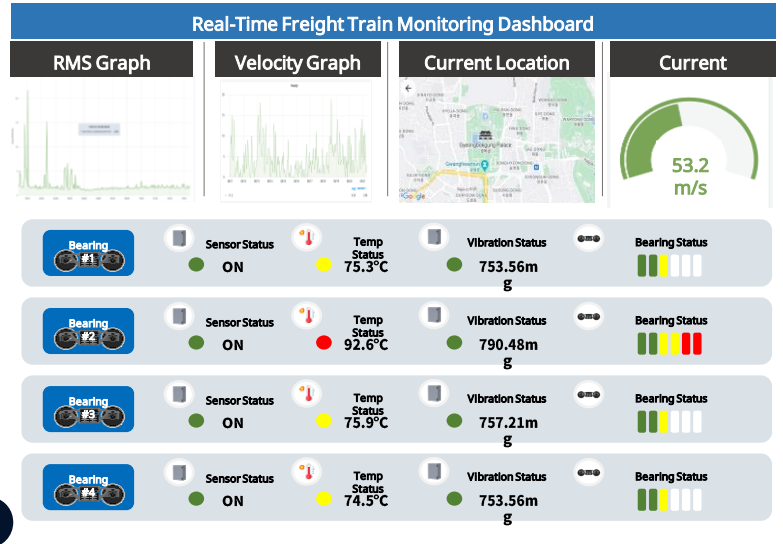
Research Projects (8)

Project ⑧: Freight Train Monitoring (Railcar firm, 2023.11–2024.02)

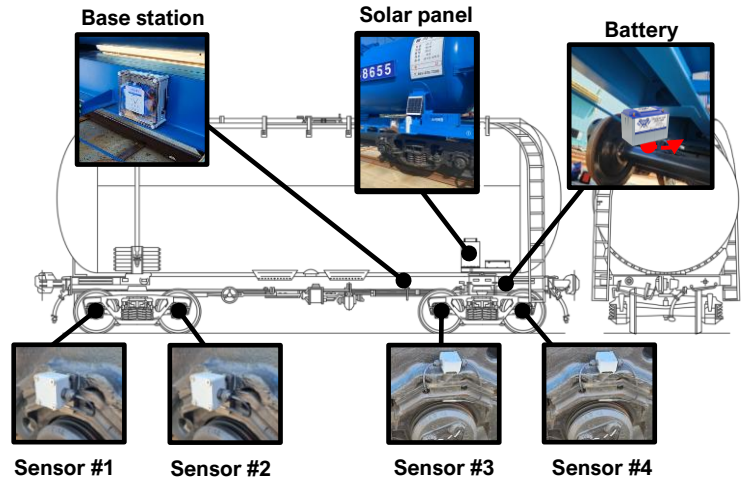
- Targeted a gap: visual inspection of freight-car bearings misses **fatigue and deformation damage** from high speeds and loads
- Developed **ultra-compact bearing sensors** to **monitor bearing vibration and temperature**, sending data to a server via **LTE**
- **Collected data on in-service freight cars**; next steps were improving stability, expanding use, and **developing bearing-diagnosis algorithms**
- Included learning **GPS-referenced anomaly patterns** to assess **track condition** as well as bearings



1. Smart Sensor



2. Cloud System

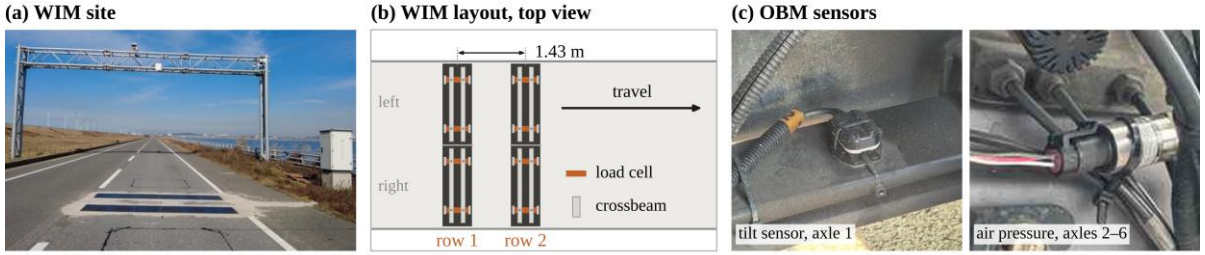


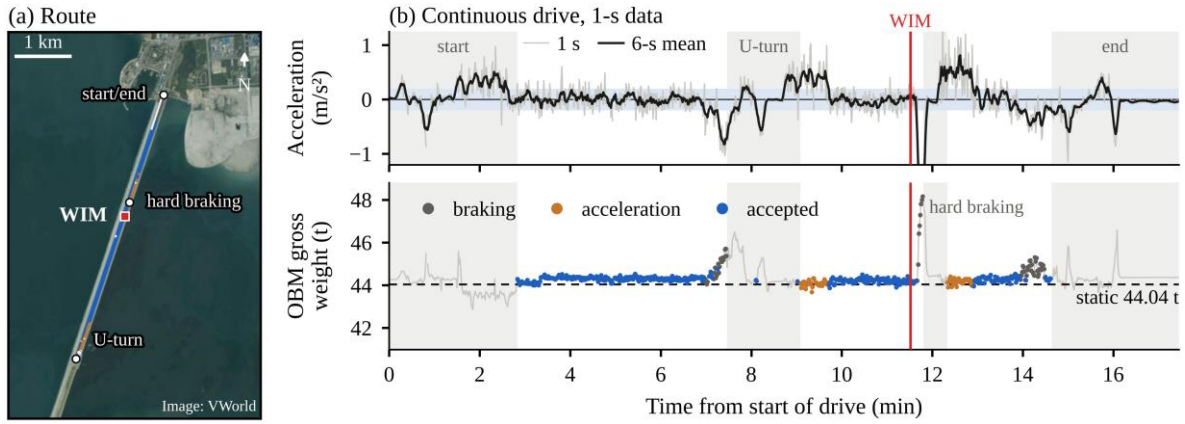


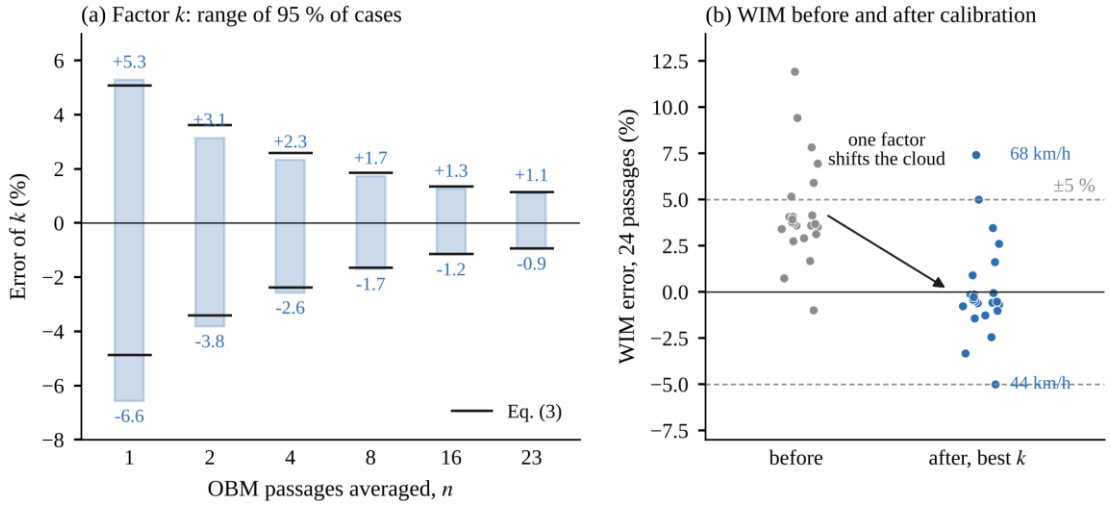
Research Projects (9)

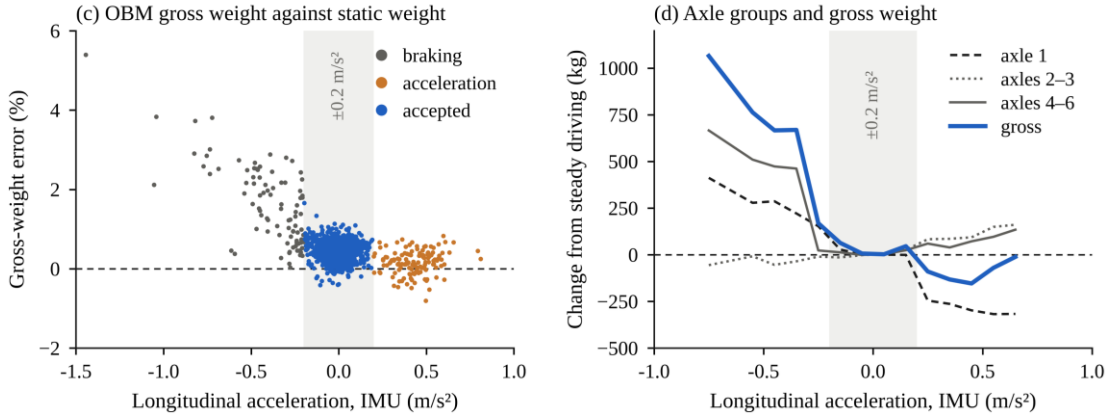
Project ⑨: Dynamic Truck Safety Assessment with Road-Infrastructure Data (MOLIT, 2024.05–2024.12)

- Estimated in-motion loads in real time via **tiltmeter–IMU fusion modules** on the leaf-spring suspension and chassis frame
- Studied ways to **stabilize load estimation** under dynamic driving conditions (centrifugal force on curves, acceleration/braking)





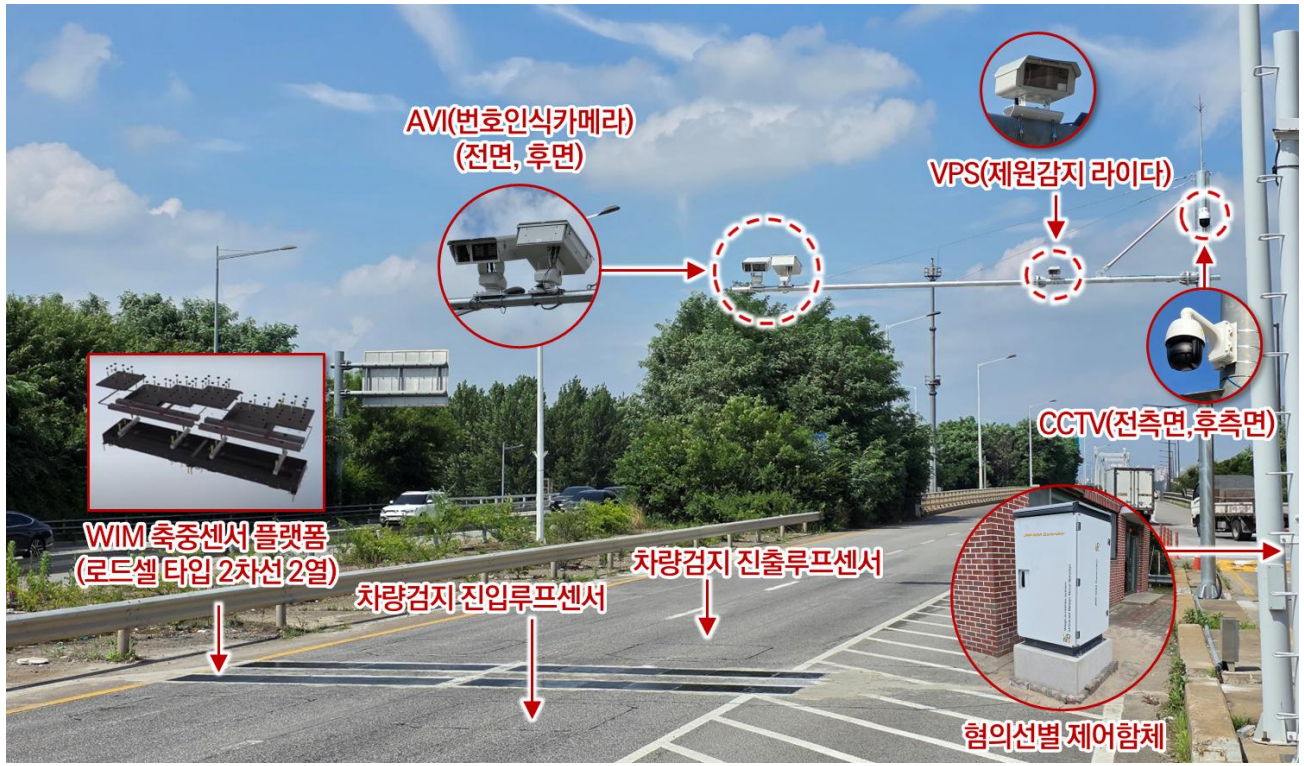




Research Projects (10)

Project ⑩: AI Data-Centric Technology for Truck Transport Safety (MOLIT, 2025.01–2026.12)

- Built and field-deployed an **HS-WIM** enforcement-support system for **pre-screening of suspected overweight vehicles**
- Detected vehicles and measured per-axle loads with a **load-cell WIM platform** (two rows per lane) and entry/exit loop sensors
- Checked measurement performance through **test vehicle** runs and real-time raw-signal monitoring

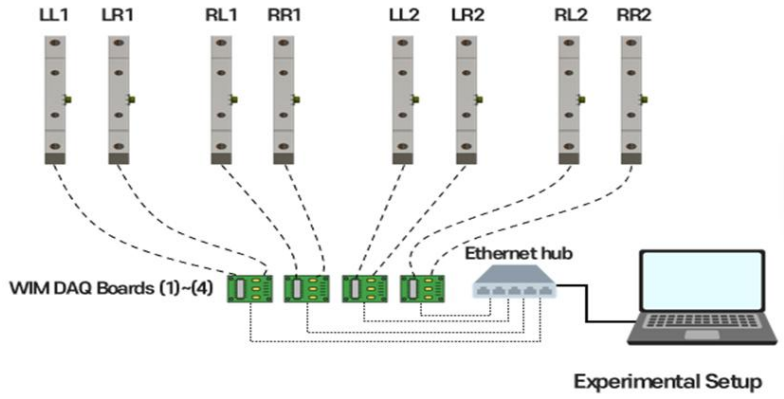




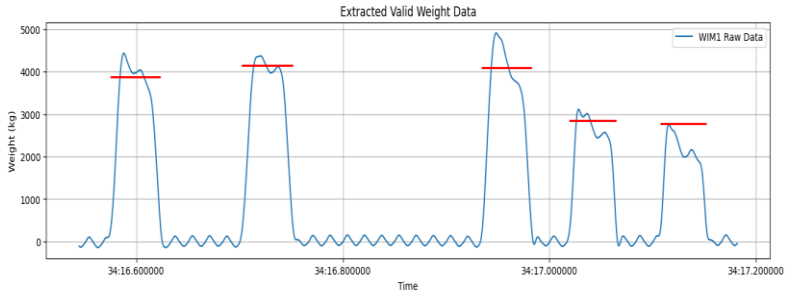
Research Projects (10)

Project ⑩: AI Data-Centric Technology for Truck Transport Safety (MOLIT, 2025.01–2026.12)

- Took part in designing and developing a **WIM DAQ board** replacing NI equipment and a **modular strip-type WIM** architecture
- Implemented **50 kHz multichannel acquisition** with filtering, **5 kHz downsampling**, and an **18-bit ADC**
- **Downsized the roadside cabinet** via **PoE power** and load-cell integration, easing installation and operation
- Redesigned the **scale factor and weight algorithm** for NI DAQ differences; validated with field driving data



Experimental Setup



WIM DAQ 보드 단위 변환

1. 비트 → 전압 변환
   - AD7989 입력 전압 [V] = 비트 값 [bit] × (인가 전압 / 비트 분해능) [μV/bit]

$$V_{DAQ} = N_{bit} \times \underbrace{(V_{EXT}/2^N)}_{152.58789\,\mu V/bit}$$

LSB means least significant bit. With the ±5V input range, 1 LSB is 152.58789μV

   - 여기서, 인가 전압은 10V(5V Differential), 비트 분해능은 2^{16}
   - (ADC는 18비트 이지만 바이너리 전송 효율을 높이기 위해서 2바이트(16bit)만 스케일 다운해서 사용, 2비트 버림)
2. 증폭기 Gain 보정
   - 로드셀 출력전압 [V] = AD7989 입력 전압 [V] / Gain

$$V_{loadcell} = V_{DAQ} / \underbrace{G_{amp}}_{99}$$

3. 풀스케일 비율 계산
   - 풀스케일 비율 = 로드셀 출력전압 [V(V/V)] / 로드셀 감도 [V/V]

$$R_{fullscale} = V_{loadcell} / \underbrace{S_{loadcell}}_{0.003\,V/V}$$

4. 최종 중량 변환
   - 최종 중량 [kg] = 풀스케일 비율 / 로드셀 정격용량[kg]

$$W_{final} = R_{fullscale} \times \underbrace{W_{fullscale}}_{22{,}200\,kg}$$



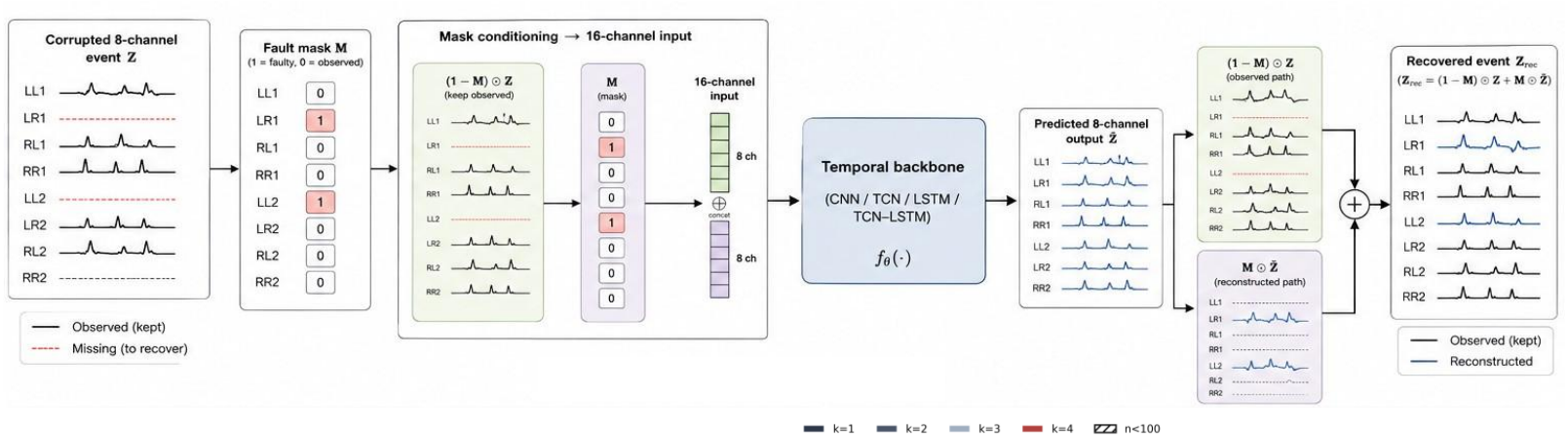
> $W_{final} = \left(\frac{(N_{bit} \times (V_{EXT}/2^N))}{5V} / Gain\right) \times (W_{fullscale} / S_{loadcell})$
> $= N_{bit} \times (152.58789uV/5/99) \times (22200/0.003)$
> $= N_{bit} \times 2.281112$

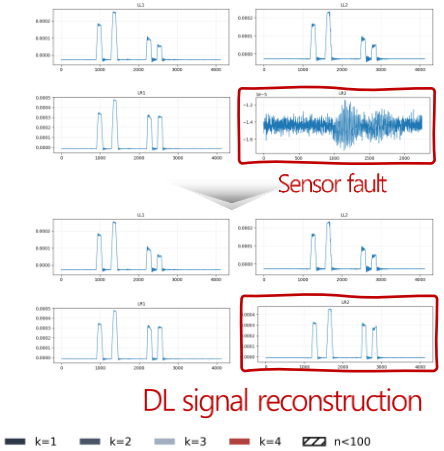
> **스케일 팩터 = 2.281112 [kg/bit]**

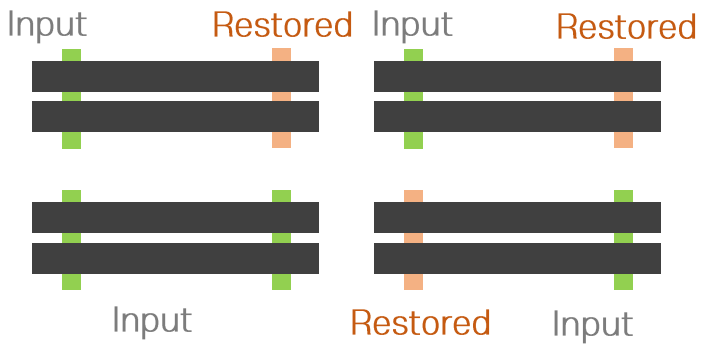
Research Projects (10)

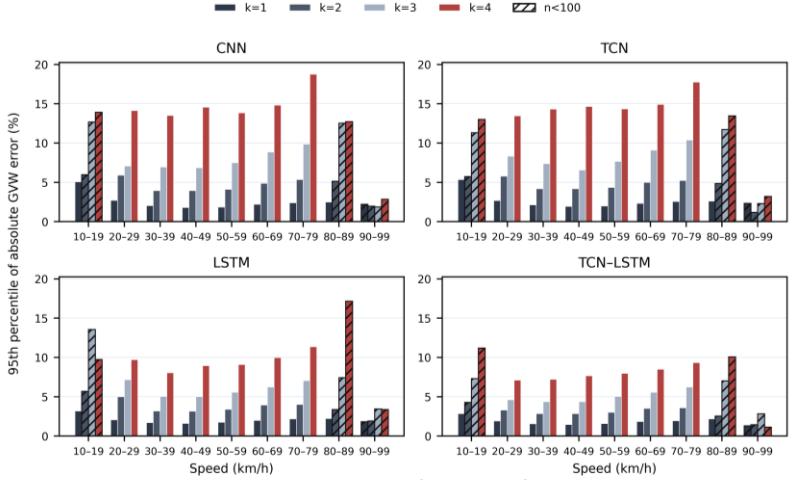
Project ⑩: AI Data-Centric Technology for Truck Transport Safety (MOLIT, 2025.01–2026.12)

- Implemented and applied a **time-series deep-learning model** to reconstruct failed-sensor signals
- Analyzed reconstruction accuracy by speed and vehicle class across **CNN, LSTM, TCN, and TCN-LSTM** models

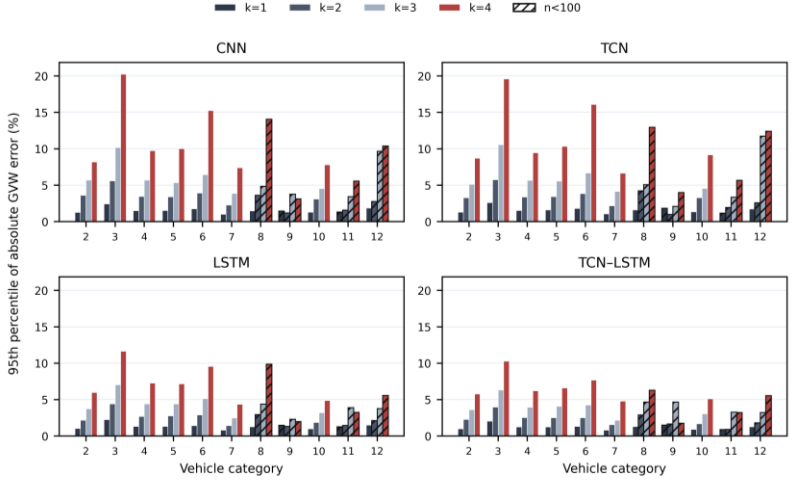








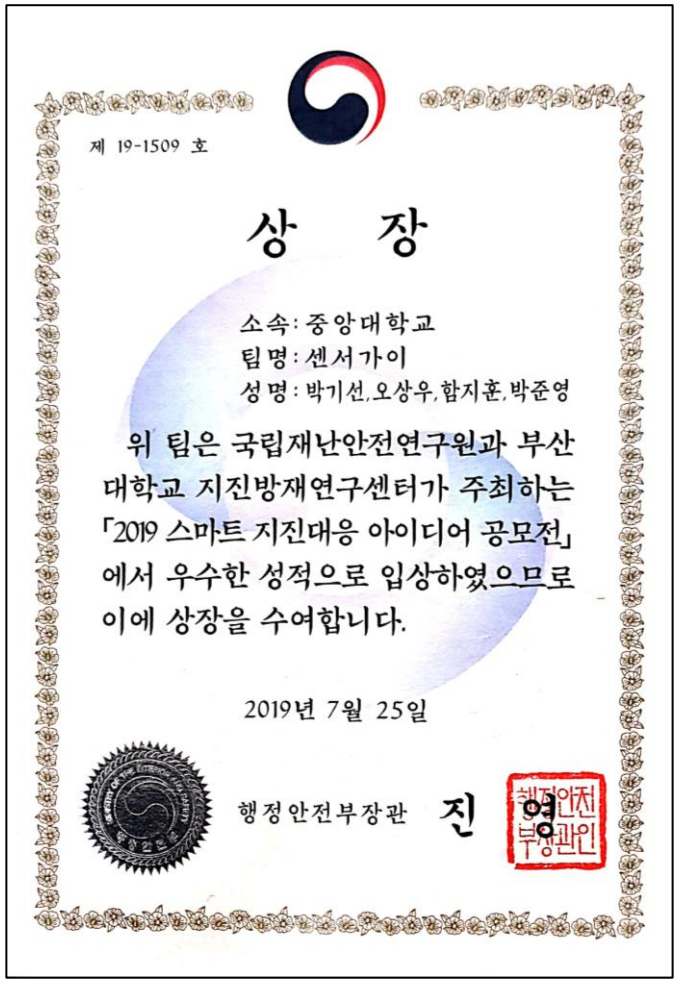
▲ Accuracy by speed



▲ Accuracy by vehicle class

Selected Awards

Selected Awards (1)



제 19-1509 호

상 장

소속: 중앙대학교
팀명: 센서가이
성명: 박기선,오상우,함지훈,박준영

위 팀은 국립재난안전연구원과 부산대학교 지진방재연구센터가 주최하는 「2019 스마트 지진대응 아이디어 공모전」에서 우수한 성적으로 입상하였으므로 이에 상장을 수여합니다.

2019년 7월 25일

행정안전부장관 진 영

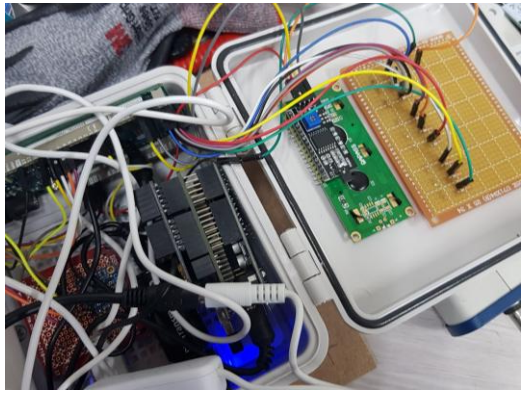
❖ Title: Earthquake Alert via Multisensory Media & Smart Sensors (2019)

❖ Research Summary

- Developed a **real-time earthquake detection algorithm** that **recognizes excessive vibration on an STA/LTA trigger** and distinguishes seismic, random, and sine waves within 10 s
- Developed a **BLE-based ultra-low-power smart seismic sensor** with the embedded detection algorithm
- Developed an **alert propagation system** over BLE using nearby Bluetooth devices
- Validated on a shaking table at Pusan National University's Yangsan Campus as **the only team to correctly classify and alert on all 10 input waveforms**, winning the Minister's Award (Ministry of the Interior and Safety)

❖ Related Article

- https://www.materic.or.kr/mobile_new/rt/content.asp?idx=162383&page=2&board_idx=1031&





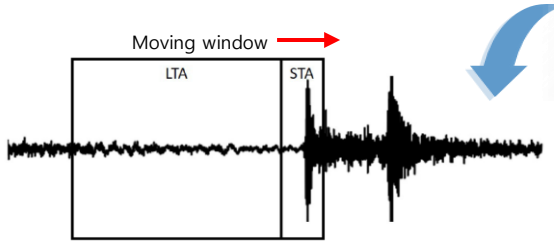


Selected Awards (1)

❖ Title: Earthquake Alert via Multisensory Media & Smart Sensors (2019)

- Proposed **real-time earthquake detection (classification) algorithm** for the competition

1 STA/LTA Algorithm



LTA (Long Time Average): mean of data over 1 s
STA (Short Time Average): mean of data over 0.05 s

$$STA(t) = \frac{1}{N_{STA}} \sum_{i=t}^{t+N_{STA}-1} |x(i)|$$

$$LTA(t) = \frac{1}{N_{LTA}} \sum_{i=t-N_{LTA}}^{t-1} |x(i)|$$

Formula of STA, LTA

- Collected 1-axis (x) acceleration at 1100 Hz
- $N_{STA} = 55 \quad N_{LTA} = 1100$: LTA averages 1 s of data and STA averages 0.05 s

2 Trigger Parameter Setting

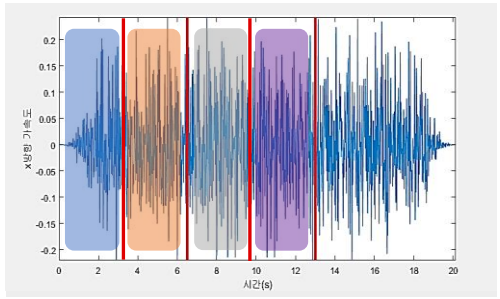
Setting N

$$\alpha < \frac{STA}{LTA}$$

Trigger Formula

- α determines when data are read
- α smaller: more sensitive; larger: less sensitive
- $\alpha = 1.6$ is set: if the 0.05-s mean acceleration exceeds 1.6× the mean over the past 1 s, a meaningful change is assumed and a trigger fires

3 Time domain Classification



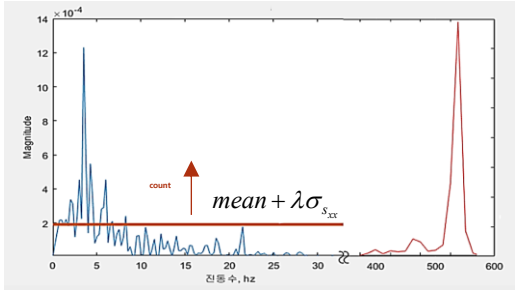
$$\frac{\min(\sigma_k)}{\max(\sigma_k)} > \tau_{random}$$

- Split 10 s of acceleration time series (1,100 samples) into 4 segments
- Identified sine waves by the variance ratio across segments, exploiting their constant vibration trend

Parameters → $\tau_{random} = 0.75$

Sine-wave condition

4 Frequency domain Classification



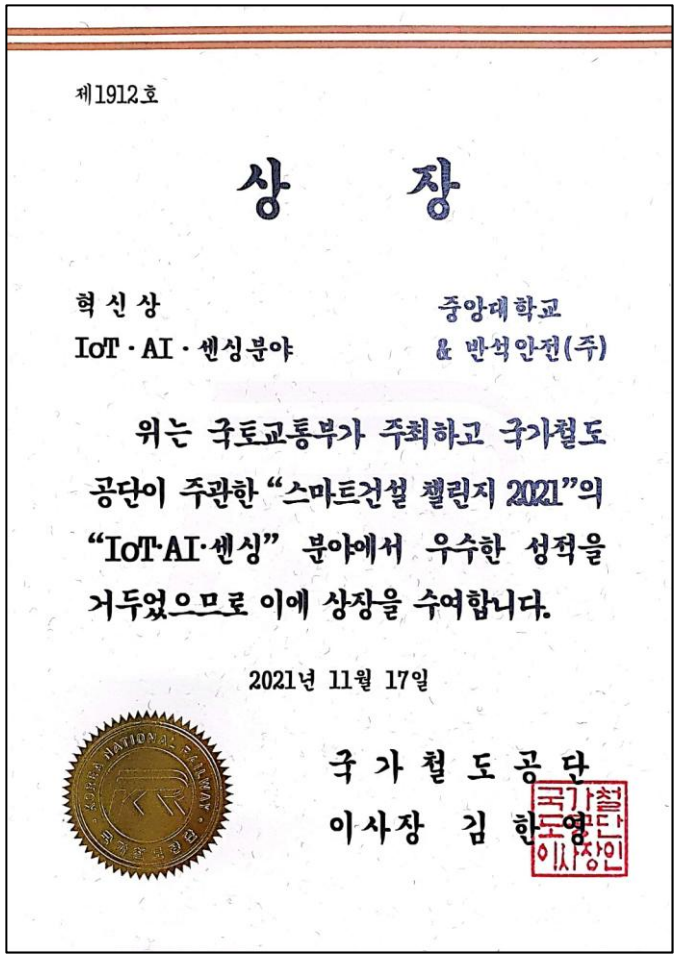
$$S_{TH} = \left\{ v \mid v > E[S_{xx}] + \lambda\sigma_{S_{xx}}, {}^{\forall} v \in S_{xx} \right\}$$

- λ determines the count
- The count separates building vibration (structure) from earthquakes

Parameters → $\lambda = 0.5$, $n(S_{TH}) > 25$

Earthquake condition

Selected Awards (2)



제1912호

상 장

혁신상 중앙대학교
IoT · AI · 센싱분야 & 반석안전(주)

위는 국토교통부가 주최하고 국가철도
공단이 주관한 "스마트건설 챌린지 2021"의
"IoT·AI·센싱" 분야에서 우수한 성적을
거두었으므로 이에 상장을 수여합니다.

2021년 11월 17일

국 가 철 도 공 단
이사장 김 한 영

❖ Title: IoT & Cloud-Based Bridge Displacement Monitoring (2021)

❖ Research Summary

- Targeted the limits of bridge maintenance built on infrequent in-depth safety diagnoses, unsustainable amid a **shrinking construction workforce** and **aging bridges**
- Developed a **system that detects bridge dynamic behavior daily**, using solar-charged **IoT sensors** without separate power and built-in LTE modems to send data to a **cloud server**
- **Computed displacement via multimetric data fusion** of JANET acceleration and multichannel strain, monitoring traffic-induced displacement and natural frequency long-term
- **Validated the system on 10+ real bridges** and entered the competition with 3+ months of results from **Cheongdam 1 Bridge (Seoul) and Paldang Overpass**
- Received the award as **the only academic participant in the session**

❖ Related Media (presentation video; presented by me)

- https://www.youtube.com/watch?v=THjvSDMGcLk



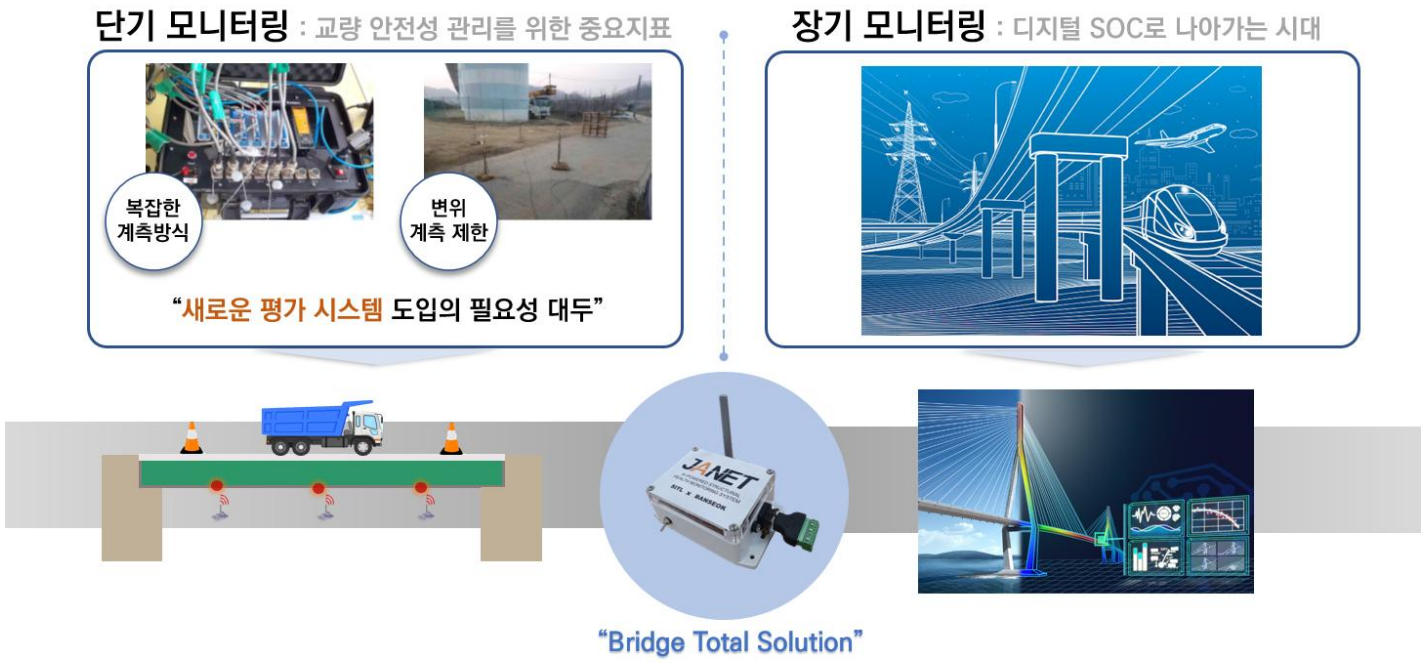


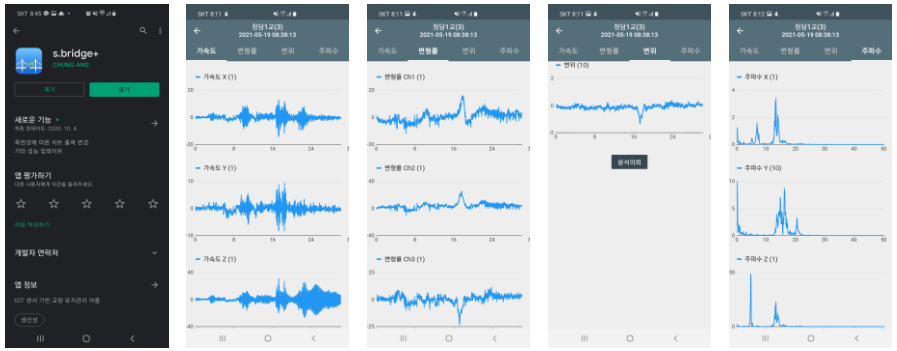


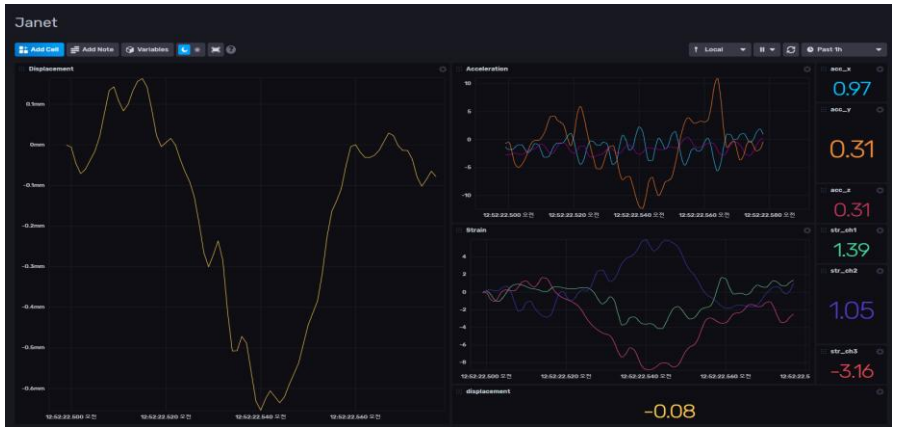
Selected Awards (2)

❖ Title: IoT & Cloud-Based Bridge Displacement Monitoring (2021)

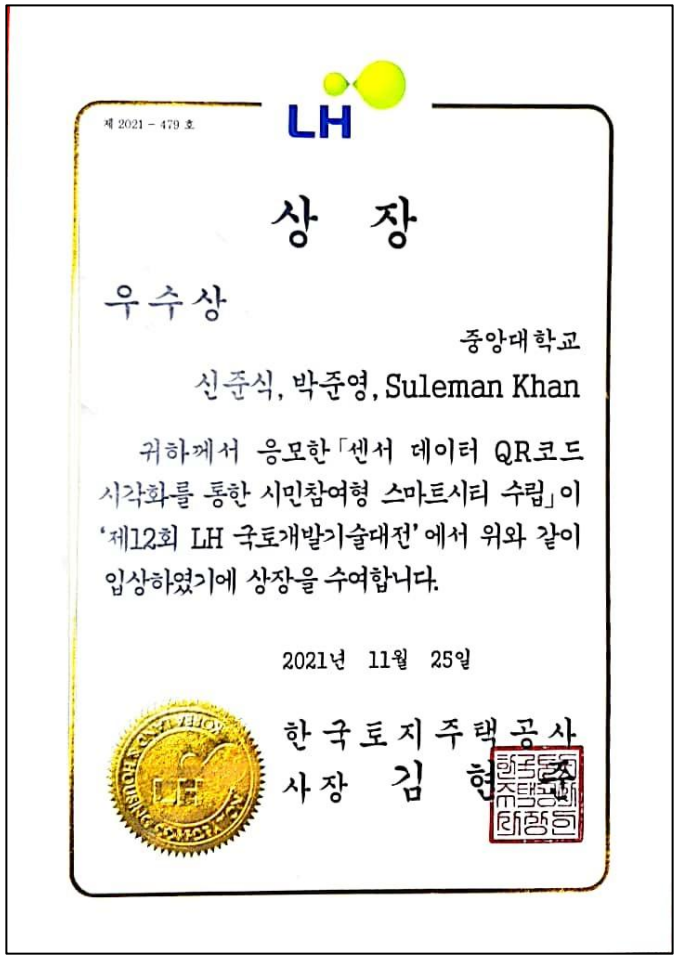
- Showcased that JANET supports both short-term monitoring (load-carrying capacity evaluation) and long-term monitoring (digital SOC)
- Showed that wireless LTE data collection enables continuous remote bridge management







Selected Awards (3)



제 2021 - 479 호

LH

상 장

우수상

중앙대학교

신준식, 박준영, Suleman Khan

귀하께서 응모한「센서 데이터 QR코드 시각화를 통한 시민참여형 스마트시티 수립」이 '제12회 LH 국토개발기술대전'에서 위와 같이 입상하였기에 상장을 수여합니다.

2021년 11월 25일

한국토지주택공사
사장 김 현

- Title: Citizen-Participatory Smart City via QR Visualization (2021)
- Research Summary
  - Developed an ultra-low-power IoT sensor that collects urban data (tilt, odor, noise, temperature, etc.) and **visualizes it as QR codes on an EPD**
  - Designed a **KakaoTalk chatbot-based data collection framework** that automatically extracts and stores data from QR codes scanned by smartphones
  - Proposed a **citizen-participatory urban maintenance model** in which passersby's "participation" collects the data, with no communication module on the sensor
- Related Article
  - https://news.cau.ac.kr/cms/FR_CON/BoardView.do?MENU_ID=10&CONTENTS_NO=&SITE_NO=5&BOARD_SEQ=1&BOARD_CATEGORY_NO=&BBS_SEQ=6508







Selected Awards (3)

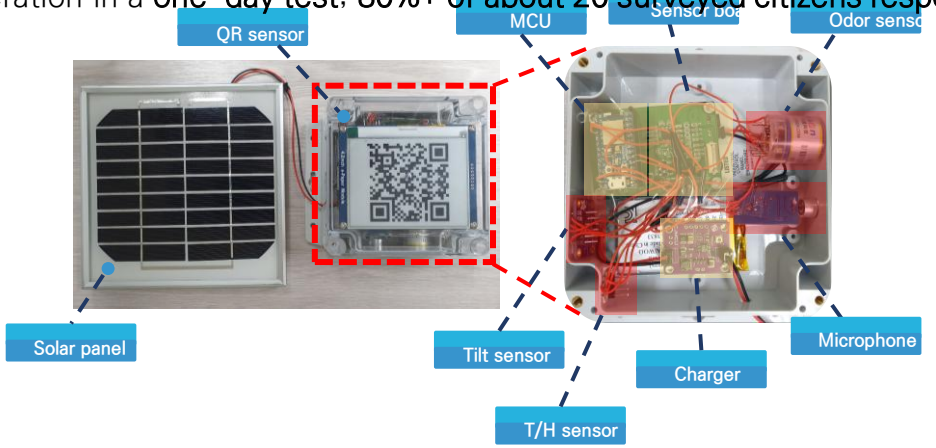
❖ Title: Citizen-Participatory Smart City via QR Visualization (2021)

- Collected urban environmental data with a sensor combining microphone, IMU, temperature/humidity, and odor sensors and a low-power MCU, and visualized the data as QR codes on E-paper
- Confirmed smooth operation in a one-day test; 80%+ of about 20 surveyed citizens responded positively



2021.08.28, Heukseok-dong

[On-campus deployment]



4 quantities, one sensor!





One install, long-term use

Dynamic QR codes!

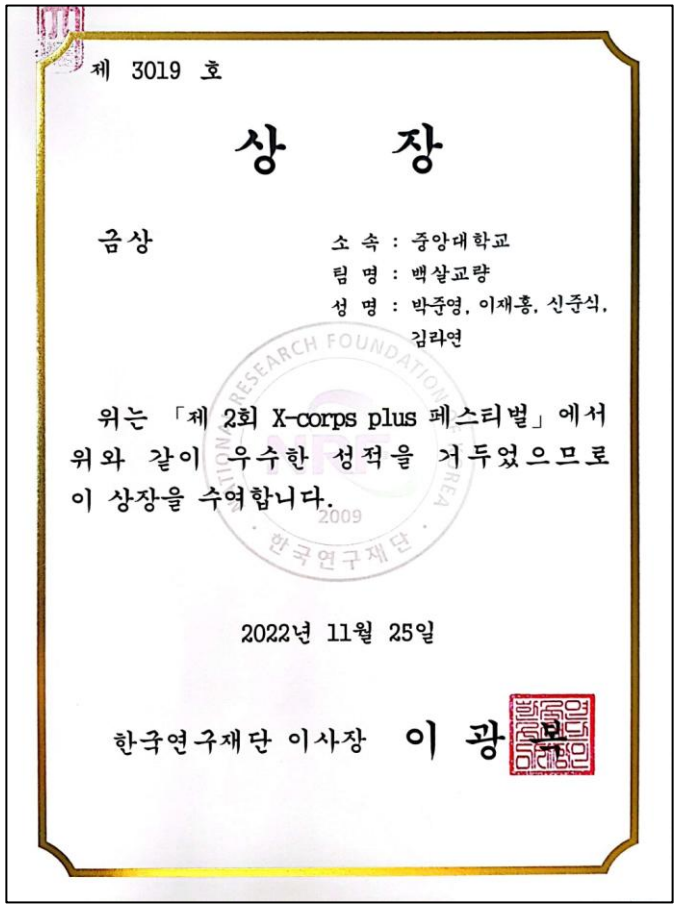


[Ultra-low-power urban sensor]



[KakaoTalk QR data pipeline]

Selected Awards (4)



제 3019 호

상 장

금상

소 속 : 중앙대학교
팀 명 : 백살교량
성 명 : 박준영, 이재홍, 신준식, 김라연

위는 「제 2회 X-corps plus 페스티벌」에서 위와 같이 우수한 성적을 거두었으므로 이 상장을 수여합니다.

2022년 11월 25일

한국연구재단 이사장 이 광

❖ Title: IoT-Based Smart Monitoring System for Stability and Quality Control of Prefab Members in Transit (2022)

❖ Research Summary

- Built a system to **monitor the condition of prefab members in transit**
- Designed a gateway sensor that measures vibration (acceleration, tilt) and multipoint strain at 100 Hz with JANET and, via Bluetooth Classic, **collects per-vehicle transport data in real time**
- Designed a **smart pad** that **senses timber-support pressure as voltage change** to **detect load distribution of members**, reporting improper loading via Bluetooth
- Developed a **real-time in-transit member safety assessment algorithm** from vibration/strain data across transport stages (lifting-loading-transport)
- Developed a **cloud-based alert system** sending real-time KakaoTalk alerts to safety managers

❖ Related Article

- http://sitl.cau.ac.kr/news.html



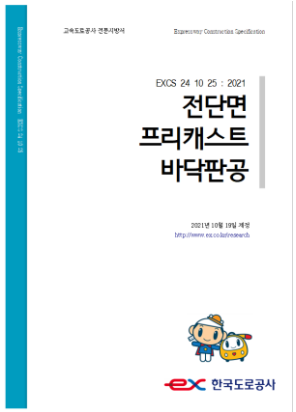




Selected Awards (4)

❖ Title: IoT Smart Monitoring of Prefab Members in Transit (2022)

- Following **the revised specification, proposed JANET and a gateway sensor** as a system to **monitor shape changes of precast panels in transit**
- Also **developed and proposed a prototype smart pad** to detect **proper timber support** and **strap tightness** affecting prefab members in transit



3.1.4 보관 및 운반

(1) 전단면 프리캐스트 패널 하면이 바닥면과 직접 접촉되는 것을 피하고 뒤틀림이 발생하지 않도록 견고한 바닥에 적절한 받침대를 설치하여 보관 및 운반하여야 한다.

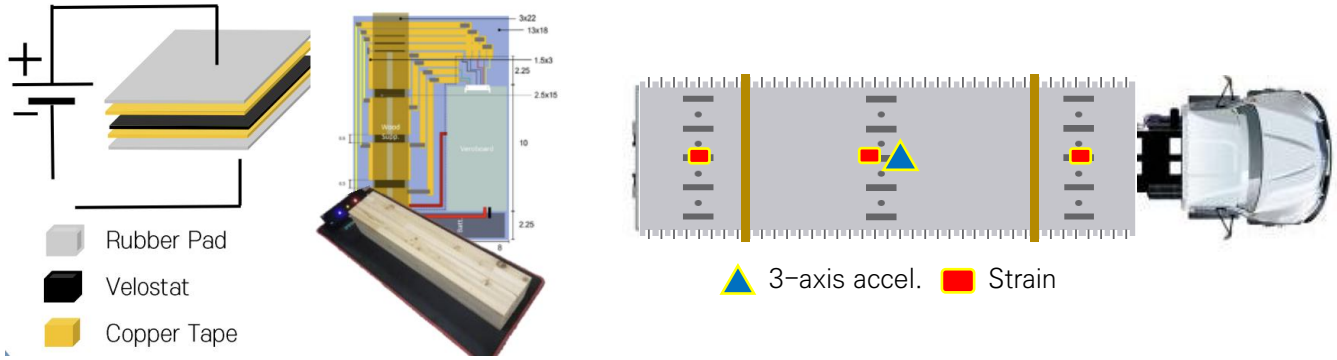
(2) 패널을 겹쳐 쌓아 보관 및 운반하는 경우에는 지점조건을 고려하여 패널의 동일한 위치에 받침대를 각각 설치해야 한다. 쌓는 패널 수는 최대 10매 이내로 하고 패널 상면은 항상 수평을 유지하여야 한다.

(3) 장기간 보관이 필요한 경우에는 노출된 철근의 부식을 방지하기 위한 대책을 마련하여야 한다.

(4) 전단면 프리캐스트 패널 설치 이전의 형상을 1회 이상 측정하여 기록·관리하여야 하며, 보관 또는 운반 중 전단면 프리캐스트 패널의 형상변화가 발생한 경우에는 조치계획을 강구하여 공사감독자에게 보고하고 조치하여야 한다.

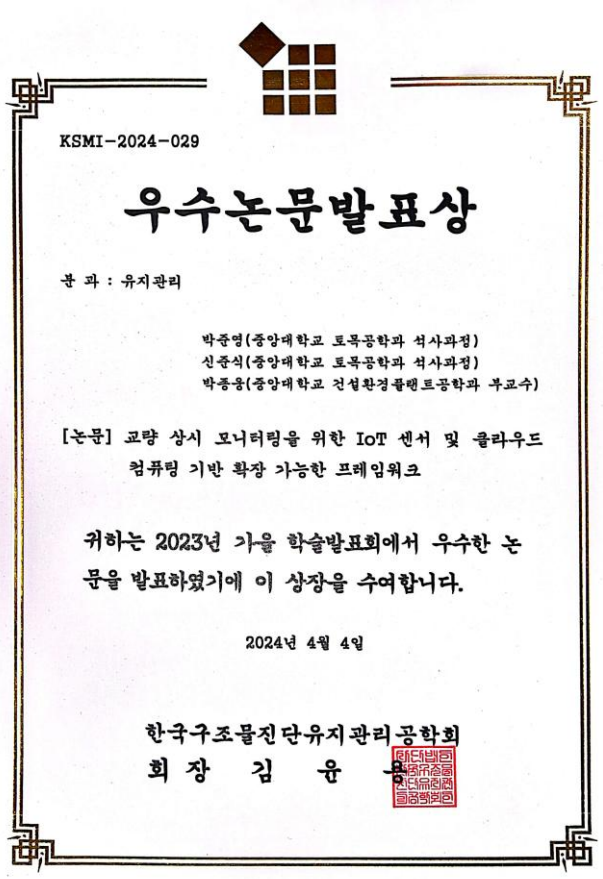


[Monitoring across all transport stages]



[Developed smart pad]

Selected Awards (5)



KSMI-2024-029

우수논문발표상

분 과 : 유지관리

박준영(중앙대학교 토목공학과 석사과정)
신준식(중앙대학교 토목공학과 석사과정)
박종응(중앙대학교 건설환경플랜트공학과 부교수)

[논문] 교량 상시 모니터링을 위한 IoT 센서 및 클라우드 컴퓨팅 기반 확장 가능한 프레임워크

귀하는 2023년 가을 학술발표회에서 우수한 논문을 발표하였기에 이 상장을 수여합니다.

2024년 4월 4일

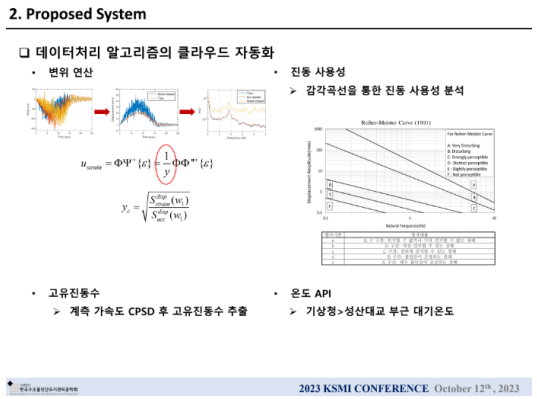
한국구조물진단유지관리공학회
회 장 김 윤 용

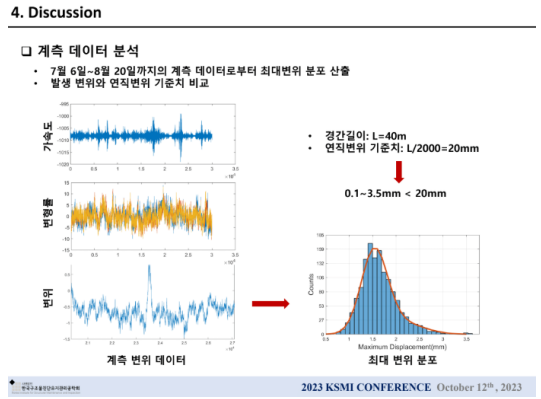
❖ Title: Scalable IoT–Cloud Framework for Continuous Bridge Monitoring (2024)

❖ Research Summary

- Targeted the limits of load-test-based bridge safety evaluation, where displacement gauges require a fixed ground reference
- Addressed why indirect acceleration–strain displacement methods remained impractical: **no precise, data-synchronized sensor**
- Developed an **IoT sensor (JANET PRO)** that **simultaneously measures acceleration (3 ch) and strain (up to 8 ch) at high resolution**, with an **event-based low-power system**
- Built a monitoring framework that evaluates bridge safety continuously and automatically through cloud-based **data fusion (displacement estimation, vibration analysis, etc.)**

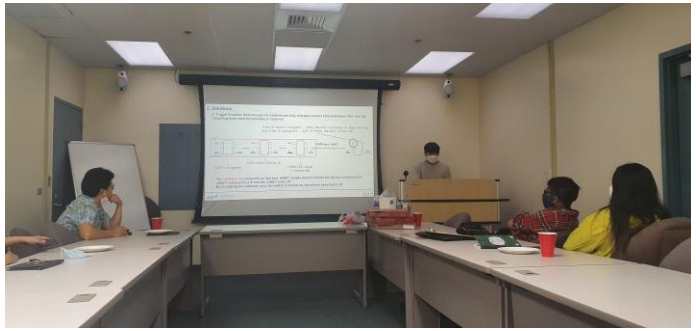




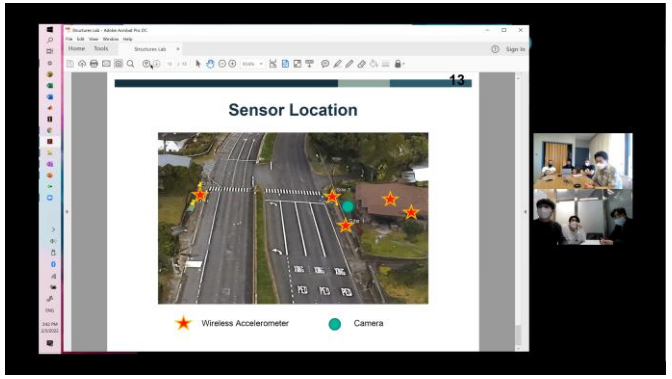


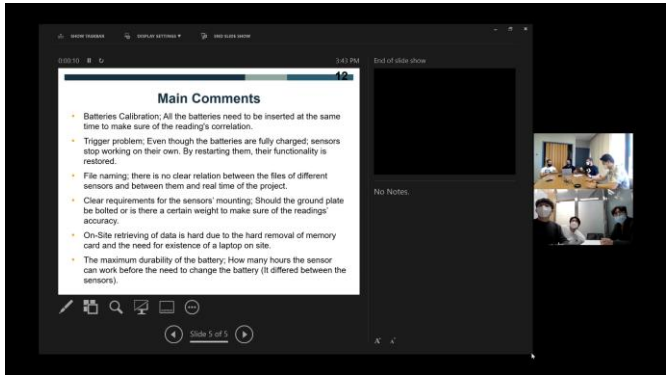
Other Activities

Other Activities (1)

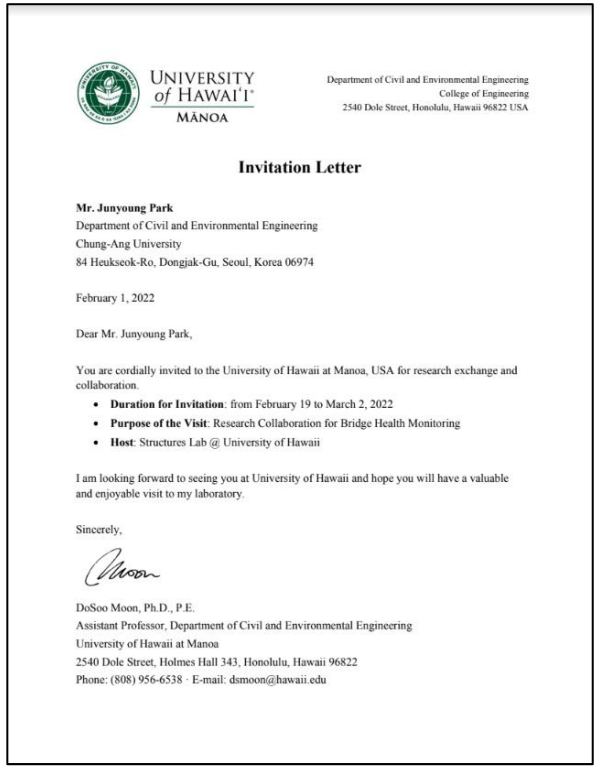


- ❖ Research Visit: University of Hawaii at Manoa (2022.02.19–2022.03.03)
  - ➢ Discussed applications of the JANET sensor developed at Chung-Ang University with Prof. DoSoo Moon's lab at the University of Hawaii, shipped sensors there, and shared field results; then **conducted a two-week research visit** at Prof. Moon's invitation
  - ➢ Gave a seminar on our research in Korea and exchanged research between the labs; also taught local students sensor fundamentals and debugging





[2022.02.04 Zoom meeting]



UNIVERSITY of HAWAI'I MĀNOA

Department of Civil and Environmental Engineering
College of Engineering
2540 Dole Street, Honolulu, Hawaii 96822 USA

Invitation Letter

Mr. Junyoung Park
Department of Civil and Environmental Engineering
Chung-Ang University
84 Heukseok-Ro, Dongjak-Gu, Seoul, Korea 06974

February 1, 2022

Dear Mr. Junyoung Park,

You are cordially invited to the University of Hawaii at Manoa, USA for research exchange and collaboration.

- **Duration for Invitation**: from February 19 to March 2, 2022
- **Purpose of the Visit**: Research Collaboration for Bridge Health Monitoring
- **Host**: Structures Lab @ University of Hawaii

I am looking forward to seeing you at University of Hawaii and hope you will have a valuable and enjoyable visit to my laboratory.

Sincerely,

DoSoo Moon, Ph.D., P.E.
Assistant Professor, Department of Civil and Environmental Engineering
University of Hawaii at Manoa
2540 Dole Street, Holmes Hall 343, Honolulu, Hawaii 96822
Phone: (808) 956-6538 · E-mail: dsmoon@hawaii.edu

[Invitation Letter]









[Visit to University of Hawaii]

Other Activities (2)

➢ Proposals Written: 16 (R&D: 9, Contract: 7)

Year	Funder	Title	Budget	Type	Selected
2026	MOLIT	Truck Weight Platform and Field Demonstration for Efficient Overweight Enforcement		R&D	✅
2025	MOIS	2025 Automated Road-Damage Detection Survey Equipment – Purchase Proposal (Draft)		Contract	✅
2024	MOLIT	2024–2025 Maintenance of the Online Permit System for Restricted Vehicles		Contract	✅
2024	MOIS	AI-Based Next-Generation Safety Reporting and Report-Value Analysis Service		R&D	❌
2024	NRF	Freight-Car Life Prediction via Wheel–Track–Bearing Monitoring and Causal Inference		R&D	❌
2024	NRF	Global Basic Research Lab on Meta-Concrete Materials and Structures		R&D	❌
2023	Seoul City	2023 IoT-Based Integrated Monitoring of Seongsan Bridge Repair Sections		Contract	✅
2023	NRF	Next-Gen Vision-Based Bridge Displacement Measurement via Cloud Physics Models		R&D	❌
2022	KALIS	Strategies for Automating Safety Diagnosis and Inspection of Infrastructure		Contract	✅
2022	KICT	IoT Sensing and Analysis Using Distance-Triggered Sources During Ship Berthing		Contract	✅
2022	MSS	Integrated AI Camera System for Automated Bridge Bearing Diagnosis		Contract	❌
2022	NRF	Non-Contact Structural Strain Measurement via Super-Macro Imaging and Cloud Computing		R&D	❌
2022	NRF	Next-Gen Vision-Based Bridge Displacement Measurement via Cloud Physics Models		R&D	❌
2021	MOLIT	Development of IoT Sensing and Cloud System for Smart Bridge Level 3		R&D	✅
2021	KICT	Sensor Module for Multivariate High-Resolution Measurement		Contract	✅
2021	NRF	Basic Research Lab on Cable Bridge Condition Assessment Using Digital Twins		R&D	❌

English Proficiency Certificate