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Case Study: Digital Equipment Management in Limak Construction & TINGZ

Transformation Office

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The Remarkable Journey of Limak's Collaboration with Startup Business Partner, Tingz

We were faced with an intriguing challenge: how to effectively monitor the work hours of Limak's construction machinery at various sites in a systematic manner. We recognized that traditional solutions like GPS or wifi were impractical and costly for our requirements. We were in need of something innovative and distinctive.

That's when we crossed paths with Tingz, a company specializing in IoT and ML solutions for digital worksites. They proposed a business partnership that would be mutually advantageous: we would provide them with real-world data and feedback, while they would equip us with intelligent sensors and analytics to optimize our fleet performance and reduce carbon emissions.

It was an opportunity we simply couldn't turn down
a true win-win situation.

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Limak Group of Companies is a thriving global enterprise based in Turkey, excelling in diverse key industries and adhering to the highest operational standards, propelling its rapid expansion.

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Construction

We specialise in infrastructure and superstructure projects in 14 countries around the globe.

Energy

We generate and distribute energy from sustainable and renewable sources.

Tourism

We are committed to welcome our guests with warm hospitality and excellent service.

Cement

We combine the latest innovations in the cement industry with efficient project financing solutions.

Infrastructure Investments

We take on challenging infrastructure projects that have a positive impact on societies.

Energy Electrical and Mechanical Contracting

We support the complex operational needs of construction sites with high-quality sustainable solutions.

Food & Beverage

We operate within the food sector, producing fruit based products.

Technology

We provide digitally oriented solutions to challenging issues in different industries.

Aviation

We provide high value aviation services through 24/7 air taxi services.

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Limak is a global company committed to generating value for stakeholders through sustainable growth, operational efficiency, and ongoing advancement.

Tingz is a cutting-edge machine learning and integration platform that offers revolutionary wireless connectivity and worksite-specific algorithms, facilitating the digital transformation of construction sites.

BACKGROUND

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The digitalization of construction sites has been a topic of extensive research and significant resources have been dedicated to it. However, the adoption of technological innovations in construction sites has been sluggish. Construction companies, in fact, have valid reasons for this.

Unlike other industries, construction sites present unique physical conditions and challenges that demand distinctive solutions and bold strides in digitalization.

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One of the major obstacles in the digitalization of construction sites lies in the fact that a significant number of these sites are situated outside the coverage area of GSM networks. Additionally, the equipment being used may not be fully compatible with GSM-based solutions. The absence of connectivity poses challenges in data collection, rendering digitization practically impossible. Another hurdle arises from the relatively short duration of construction projects, making long-term investments in digitalization unfeasible. Consequently, numerous field operations, particularly those involving construction equipment, continue to be manually managed worldwide.

To address these formidable challenges, Limak Transformation Office is dedicated to leveraging new technologies and forging strategic partnerships. By doing so, it aspires to make noteworthy contributions to innovations that will serve as a global benchmark within the construction industry.

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PROJECT

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THE PROBLEM

Construction machinery represents a significant portion of the expenses incurred on construction sites. Consequently, closely monitoring their usage, tracking their whereabouts, and accurately reporting their work hours are pivotal factors that greatly impact project costs and completion timelines. However, when projects span vast areas and involve a substantial number of operating machines, keeping tabs on all the construction equipment becomes challenging. Relying solely on manual reporting in such cases proves to be inadequate.

$13.5 Million Loss Per Year

In an average construction site housing 500 machines, the combination of manual tracking and erroneous work hour reports leads to an annual loss of $13.5 million and contributes to an excessive emission of approximately 35,000 $kgCO_2eq$.

Yusufeli Dam and HEPP
Artvin, Turkey

These figures have been derived from a comparison between reports generated through manual data entry and actual digital data. In construction sites where real-time monitoring is not feasible, the rise in CO_2 emissions can be attributed to inaccurate machine positioning and unnecessary idle times. Tingz offers prompt cost savings by effectively curbing such inefficiencies in connected work machines. Resolving this issue requires addressing two main aspects: establishing a wireless communication infrastructure that does not rely on GSM connectivity and implementing specialized techniques capable of analyzing the behavior of construction equipment.

APPROACH

**Yusufeli Dam and HEPP
Artvin, Turkey**
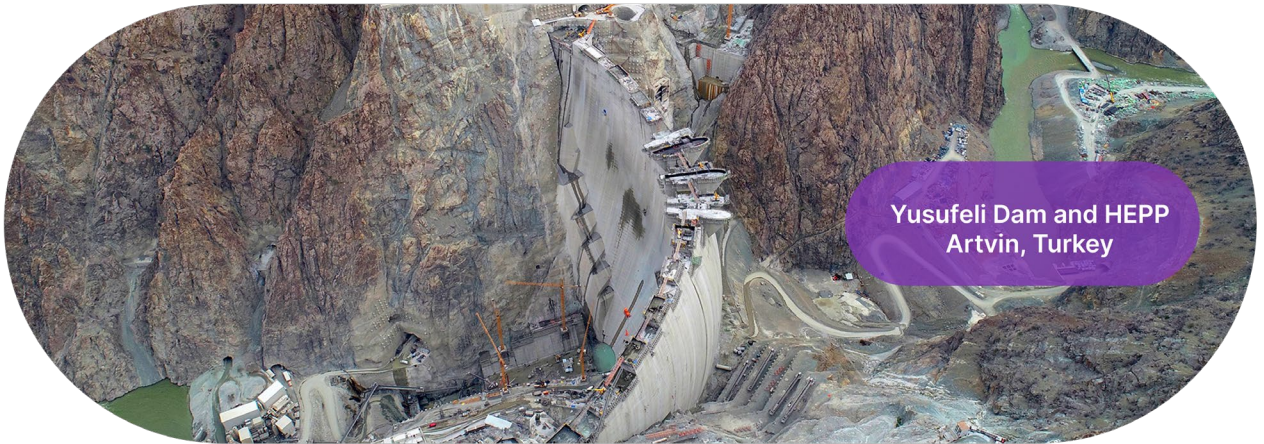
The selection of the testing location and the identification of machines to be evaluated were crucial steps in the development of the solution at hand. As a result, the Limak Yusufeli Dam construction site was chosen as the ideal working environment. The Yusufeli project was executed in a challenging geographical setting, encompassing a construction site sprawling across a 10 km diameter. Moreover, the area predominantly lacked GSM signal coverage. The presence of numerous tunnels, cliffs, and other physical obstacles within the project area made it an appropriate and demanding setting for testing an alternative wireless connectivity technology.

Yusufeli Dam and HEPP
Artvin, Turkey

During the equipment selection process, various types of construction machinery were chosen. This included wheeled loaders, earthmoving trucks, conveyor belts, as well as stationary cement and asphalt plants. Each of these equipment types underwent thorough activity analysis to gather detailed insights.

Throughout the field testing, data collection, and verification processes, the Tingz team was actively present at the construction site. They played a pivotal role in ensuring accurate measurements, validating the collected data, and overseeing the overall testing procedures.

SOLUTION

Tingz preferred **LoRaWAN technology for data communication.**

LoRaWAN is a communication protocol that operates within a license-free radio frequency spectrum, known as Low Power Wide Area Networking (LPWAN). It facilitates the collection of data over long distances while consuming minimal energy. This makes it well-suited for worksite environments where low maintenance and sustainable solutions are highly valued.

Furthermore, LoRaWAN technology has the potential to serve as a foundational framework for the digital construction site. It enables the future connection of various assets, personnel, and valuable equipment to the network, establishing a comprehensive ecosystem that enhances overall efficiency and productivity.

SOLUTION

During the machine activity analysis, the Tingz team introduced several innovations in both hardware and software. One notable development was the creation of the smart vibration module. This module serves as an electronic solution that seamlessly integrates with standard tracking sensors, allowing for real-time analysis of machine vibrations through edge computing. The data collected from the module played a vital role in the development of activity algorithms.

As a result, Tingz successfully implemented a system that could distinguish and categorize various activities of construction machines. This included differentiating between working, idling, loading, and the number of trips conducted by each machine.
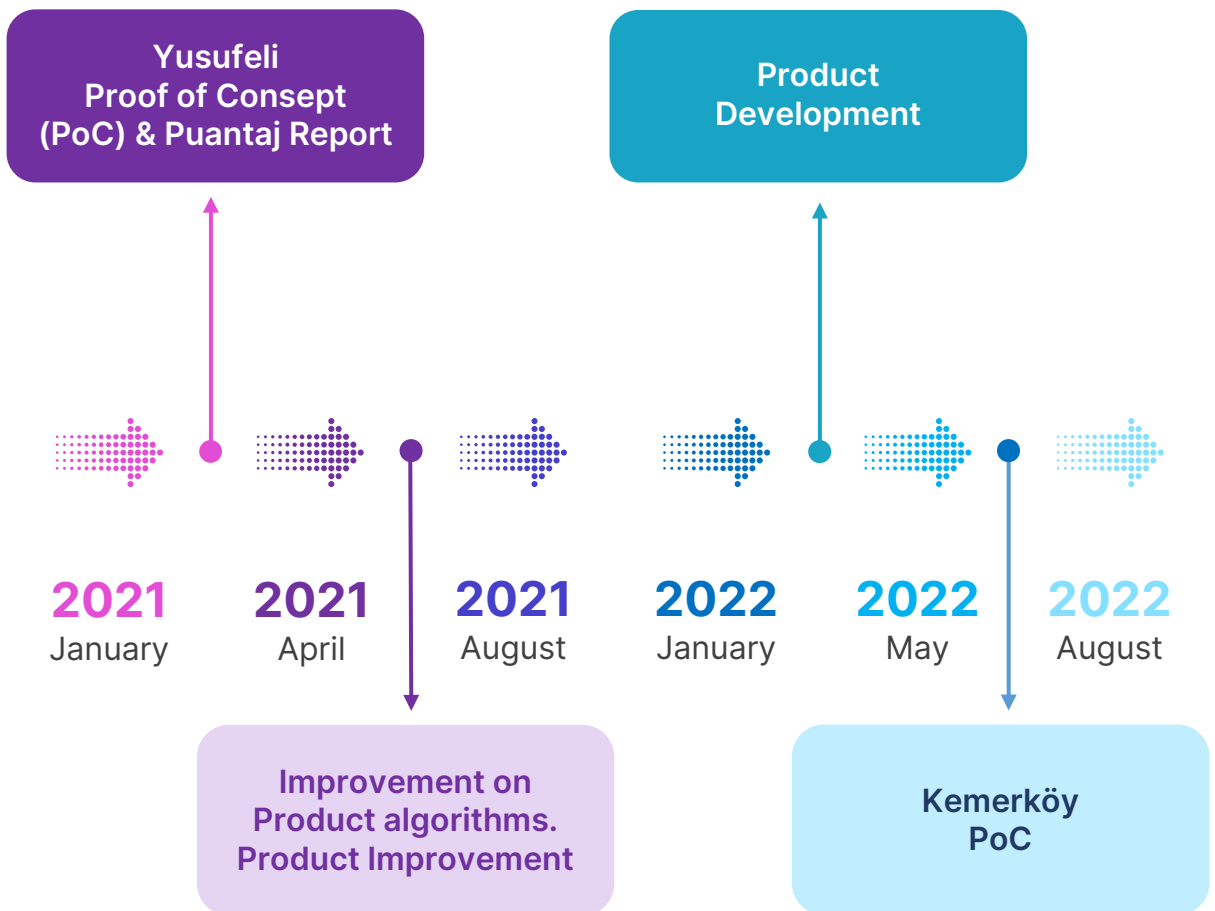
By comparing these activities with geofence information, it became feasible to generate a comprehensive overview of the construction site and deliver highly accurate score reports.

To ensure scalability, Tingz developed a dedicated IoT platform specifically designed for construction sites. This platform effectively integrates and orchestrates data from Tingz sensors with various other data sources. The objective was to establish the required software infrastructure for the future digitalization of construction sites.

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TIMELINE

Yusufeli Proof of Consept (PoC) & Puantaj Report

Product Development

2021 January

2021 April

2021 August

2022 January

2022 May

2022 August

Improvement on Product algorithms. Product Improvement

Kemerköy PoC

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RESULTS

Through collaborative efforts, a construction site-specific Industry 4.0 product was successfully developed. The product development endeavors achieved the following goals:

- Data collection in challenging geographies and underground mines became feasible without any loss.

- Fuel costs and carbon emissions were reduced by minimizing unnecessary idle times and optimizing resource allocation.

- A robust infrastructure was established to support the concept of a digital construction site, encompassing both wireless connectivity and a software platform.

- Overall, the joint work led to the creation of a cutting-edge solution that addresses the unique requirements and challenges of construction sites, paving the way for enhanced operational efficiency and sustainability.

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RESULTS

%90
ACCURACY
**Detecting
Machine Activities**

%99
ACCURACY
**Detecting
Total Working Hours**

The developed algorithms proved to be highly accurate, achieving a **90%** precision in detecting machine activities and a **99%** accuracy in calculating total working times. These precise measurements were instrumental in generating scoring reports and optimizing maintenance processes based on the collected data. By leveraging the algorithmic insights, construction site operations could be more effectively monitored, evaluated, and streamlined for improved performance and efficiency.

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