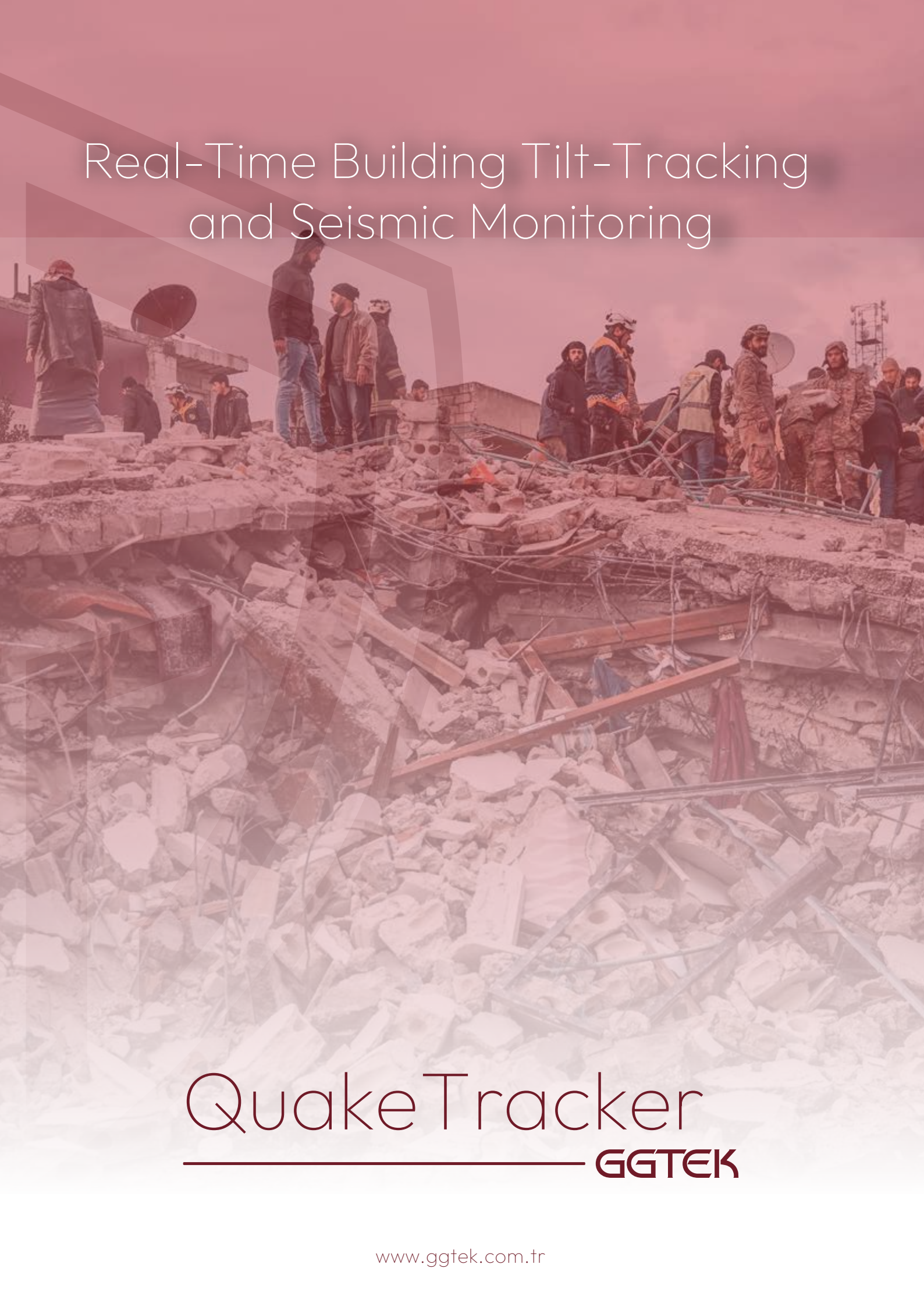
Real-Time Building Tilt-Tracking and Seismic Monitoring



QuakeTracker

GGTEK

www.ggtek.com.tr

What is the problem?

Earthquakes are one of the most dangerous natural disasters, causing massive destruction around the world every year. Around 500,000 earthquakes are recorded each year, and 100,000 of these are felt by humans. According to the United Nations Office for Disaster Risk Reduction, earthquakes have killed 1.3 million people worldwide in the last 20 years. In particular, the loss of structural integrity of buildings during earthquakes leads to sudden collapse and major damage. Turkey is located in Europe's most active earthquake zone and 17,000 people lost their lives in the 1999 Marmara Earthquake. 98% of Turkey is under earthquake risk, and the recent earthquakes in Izmir (2020) and Kahramanmaraş (2023) have once again demonstrated the seriousness of this threat. The inability to monitor the instantaneous shaking movements and tilt changes of buildings increases the loss of life and property and reveals the need for a more effective monitoring system.

Risks and Hazards During an Earthquake

The greatest danger during an earthquake is the loss of structural integrity of buildings. This creates a serious risk of collapse, especially in weak or old buildings. Structural damage can cause the columns, beams and walls of buildings to break, crack and eventually collapse completely. Especially in tall buildings, this risk of collapse can lead to greater loss of life and material damages. Another important danger during earthquakes is the problem of slope.

The slope that occurs in the foundations of buildings or between floors can cause the structure to become unstable and suffer major damage. Slope changes increase the risk of the structure toppling over and sudden collapse may become inevitable if not intervened quickly. Secondary hazards such as post-earthquake electrical fires, gas leaks and water pipe bursts also pose a great risk.

Inadequate building inspection and outdated early warning systems fail to detect these hazards in time, making intervention and rescue efforts difficult. Therefore, monitoring the instantaneous shaking and tilt data of buildings is vital for effective protection and prevention against earthquakes.

Our Solution

Seismic Sensor Detailed Period Analysis

The earthquake sensor solution we have developed to minimize the dangers posed by earthquakes and the structural risks to which buildings are exposed opens a new era in building safety. Our sensors are placed at the four corners of the building and continuously monitor instantaneous shaking movements and changes in the slope of the structure.

Integrated with a central device, this system collects real-time data and keeps the structural integrity of buildings under control at the time of an earthquake. This solution analyzes not only the intensity of the earthquake but also the condition of the building, detecting possible damages in advance and providing early warning.

It minimizes the risk of collapse by detecting tilts and deformations that occur during an earthquake. Thanks to a fast and reliable monitoring system, the safety level of buildings is increased and intervention processes are made more effective. This system, which can be applied in both residential and commercial buildings, provides critical protection in areas with high earthquake risk. Our earthquake sensors integrated with Hezitech technology make buildings more durable and resilient by offering security measures together. We provide the strongest defense against the uncertainties brought by the earthquake.

Technology and Innovation

Our developed earthquake sensor system is equipped with the most advanced technologies and innovative solutions. This technology is designed to enhance the structural safety of buildings and provide proactive solutions against earthquake risks.

High-Sensitivity Sensor Technology: Our system is equipped with high-sensitivity sensors that can detect the effects of an earthquake in great detail. These sensors accurately and reliably capture the movement and tilt changes of buildings during seismic events.

Centralized Data Collection and Advanced Analysis Capabilities: Data from all sensors is collected in a central system and instantly evaluated using big data analysis techniques. This allows for the quick and accurate analysis of a building's response to an earthquake, enabling the early detection of potential structural damage.

Real-Time Monitoring and Warning Mechanisms: Our system continuously monitors real-time data and triggers automatic warning and alarm systems if threshold values are exceeded. This feature enables timely intervention during emergencies, minimizing the risk of loss of life.

Long-Term Data Storage and Structural Performance Assessment: Data collected during earthquakes is stored for long-term analysis, allowing the evaluation of the building's performance over time. This makes it possible to conduct long-term assessments of the structural integrity of buildings.

User-Centered Interface: The panel we developed offers a user-friendly and easily accessible interface, allowing both technical experts and non-technical users to easily monitor the data.

Installation and Use

Earthquake sensors are fixed at the four main corners of the building and the central device is placed in the center of the building. The sensors transmit data to the central device via wireless or wired connection. Once the installation is complete, the system is tested to verify that all devices are working properly and data is being collected correctly. These processes ensure continuous monitoring of building security and early detection of potential risks.

Devices

The two main devices used in this project are sensors and a gateway unit. Both devices work in an integrated manner to monitor the structural integrity of buildings during earthquakes and analyze the required data instantaneously.

Sensors

The sensors used in our project are advanced devices equipped with high-precision sensors placed at the four corners of the building. These sensors measure in real time the acceleration, motion and tilt changes that buildings are exposed to during shaking. Thanks to their sensitivity, these sensors can detect even the smallest vibrations, detect deformations that may occur on the building and activate the early warning mechanism.

The sensors used in our project are advanced devices equipped with high-precision sensors placed at the four corners of the building. These sensors measure in real time the acceleration, motion and tilt changes that buildings are exposed to during shaking. Thanks to their sensitivity, these sensors can detect even the smallest vibrations, detect deformations that may occur on the building and activate the early warning mechanism.

The main features of the sensors are as follows:

- Precision Accelerometers: Accurately detects the shaking acceleration of the building during earthquakes.

- Tilt Sensors: Instantly monitors changes in the structural slope of the building, enabling early detection of slope-induced collapse.

- Low Power Consumption: Optimized for long-term operation, providing energy efficiency.

- Wireless Data Transfer: Sensors transmit their data wirelessly to the gateway device.

Gateway

The Gateway device acts as the central control unit of the system, collecting, analyzing and transmitting data from all sensors to the center. Placed in the center of the building, it brings together all the data collected by the sensors and provides an integrated analysis. Gateway plays a critical role in organizing and processing the data and generating alerts that enable quick action during an earthquake.

The main features of the gateway device are:

- Data Collection and Processing: Instantly collects and analyzes data from all sensors and triggers the necessary warning and alarm systems.

- High Connection Reliability: Continuously communicates with sensors over a wireless connection and ensures uninterrupted data flow.

- Real-Time Data Analysis: It instantly evaluates the tilt, acceleration and deformation information of buildings during an earthquake.

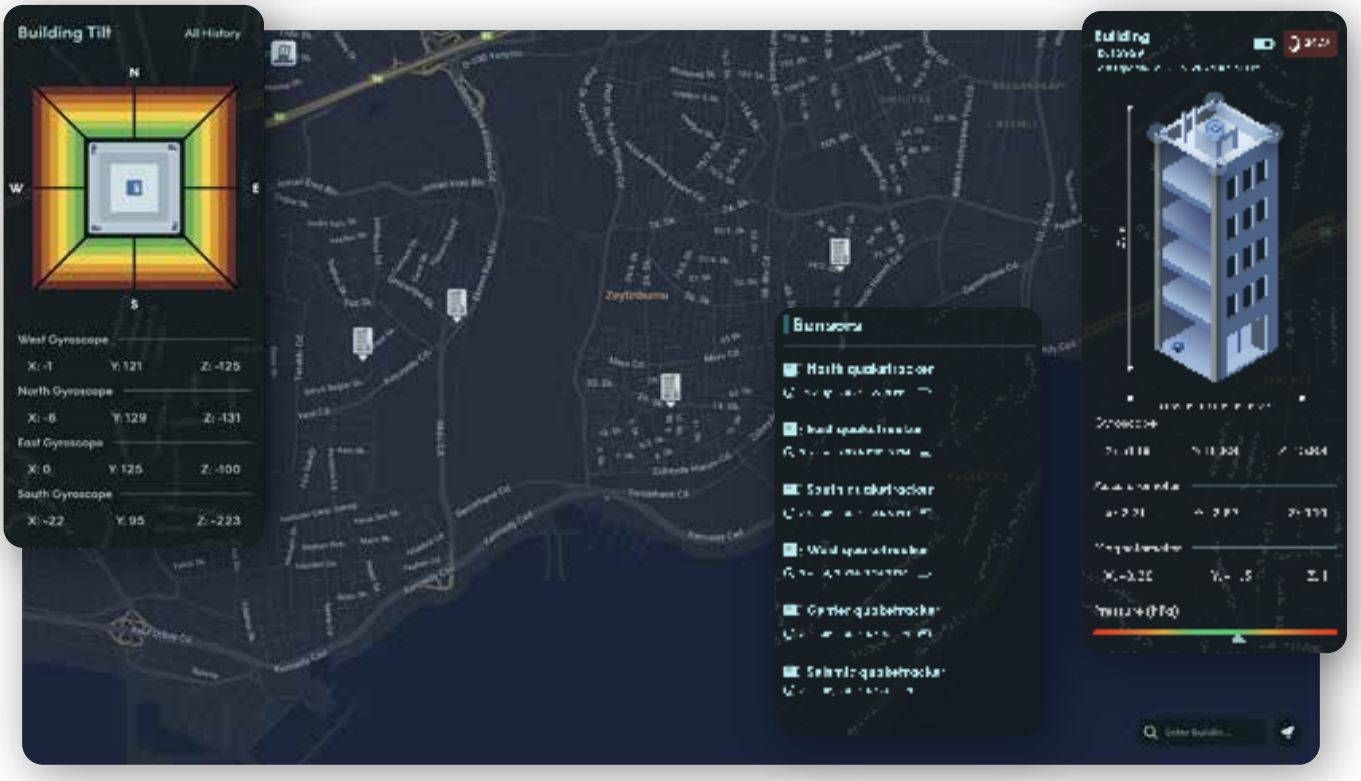
- Remote Access: Users can get continuous information about building safety by providing remote access to the gateway device.

- Emergency Warning System: During an earthquake or when a critical structural change is detected, the gateway device quickly sends warning signals, enabling emergency intervention.

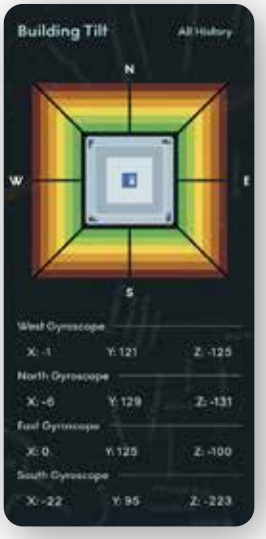
User Friendly and Powerful Web Panel

The web panel we developed allows users to instantly monitor the status of the devices working in integration with the sensors. Through the panel, the slope data measured by the sensors placed at the four corners of the buildings monitored through the map can be viewed in detail and the direction in which the building is sloping can be determined with this data.

In addition, all vibrations and seismic movements recorded in the system can be examined by users in tabular format, which makes it possible to evaluate the structural performance of the building during an earthquake and make long-term analyzes. With its user-friendly interface and comprehensive data analysis capabilities, the web panel provides an important solution to ensure the safety of buildings.



In this section, all critical data from the sensors integrated in the building can be monitored in detail. In addition to the building's height, temperature and battery level, data from the gyroscope, accelerometer, magnetometer and pressure sensors are also presented in real time. The gyroscope provides tilt data of the building on the X, Y and Z axes, allowing to monitor the directional stability of the building. The accelerometer measures the acceleration and vibration movements of the building, while the magnetometer observes magnetic field changes. The pressure sensor provides ambient pressure readings, allowing changes in environmental conditions to be monitored. This data provides comprehensive information about the structural condition of the building, enabling users to make quick and effective interventions.



In this section, which is monitored through the web panel, the slope direction and degrees of the building are shown in detail in line with the data received from four different sensors on the building. When users select their building on the map, they can instantly track the direction in which the building is sloping through sensors placed in the north (N), south (S), east (E) and west (W) directions, based on the mobility data on the X, Y and Z axes. This tilt data is critical to assess whether the structural stability of the building is maintained and to intervene if any risk is detected.

GGTEK

Gelişmiş Güvenlik Teknolojileri

(0312) 299 25 39

Yukarı Dikmen Mahallesi Aleksander Dubçek Caddesi
No:1F Çankaya Ankara