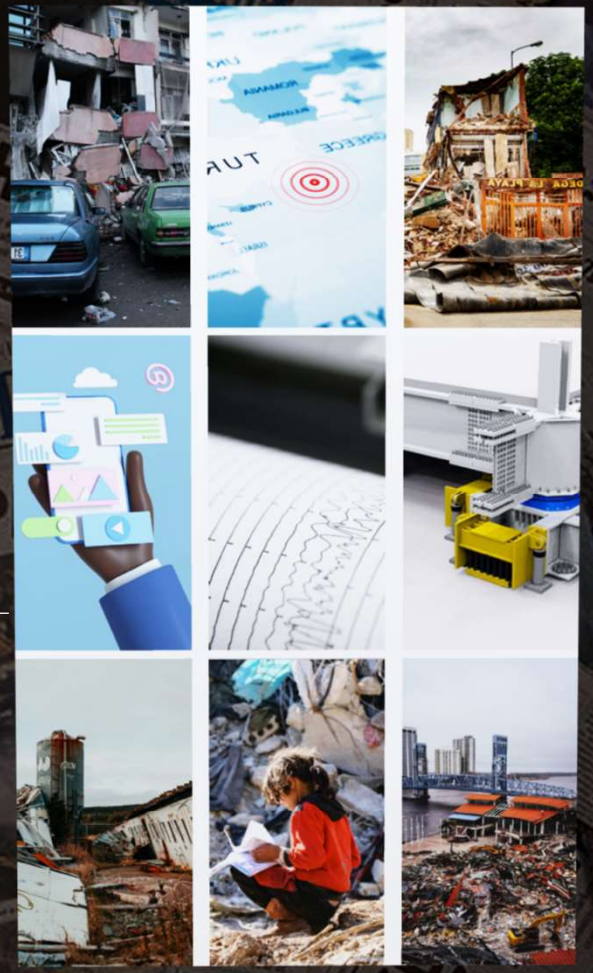
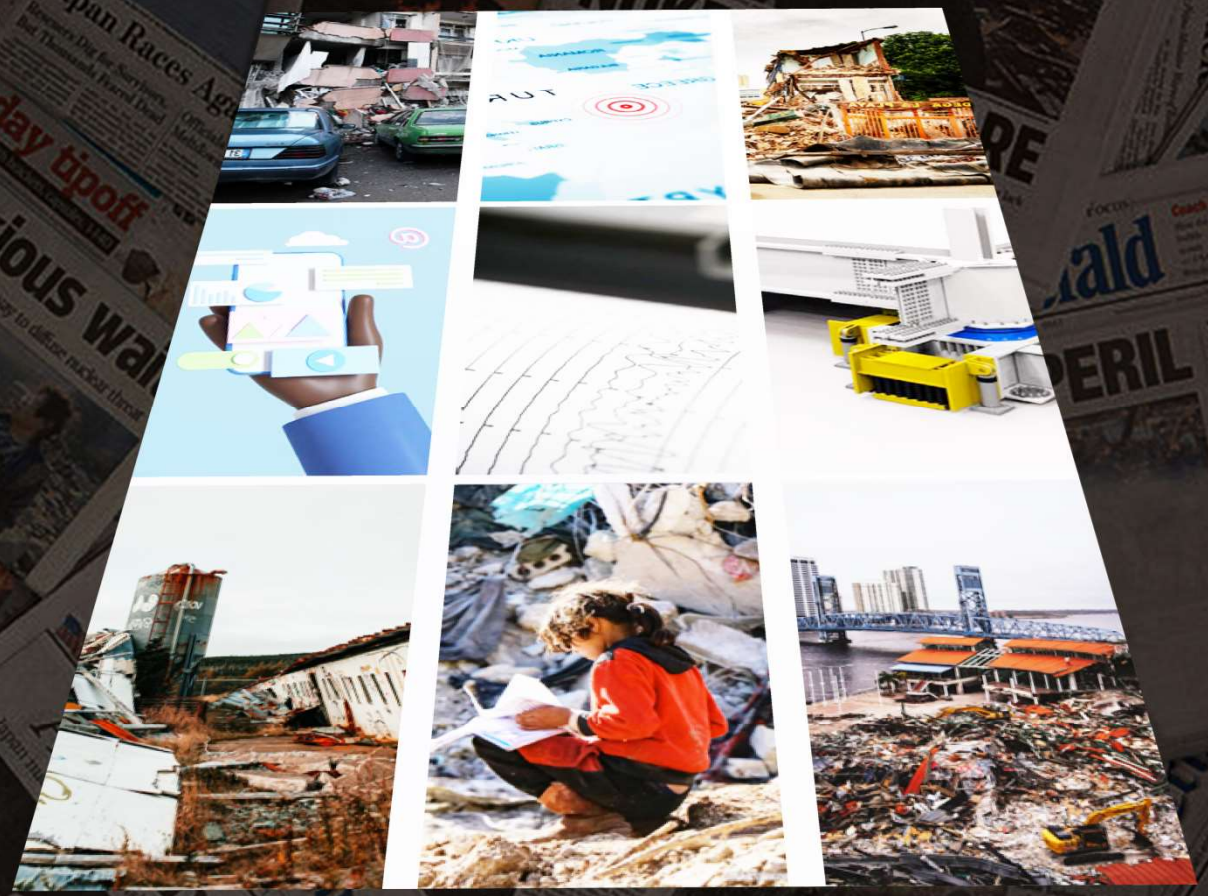
QUAKE-PROOF

The power of base isolation



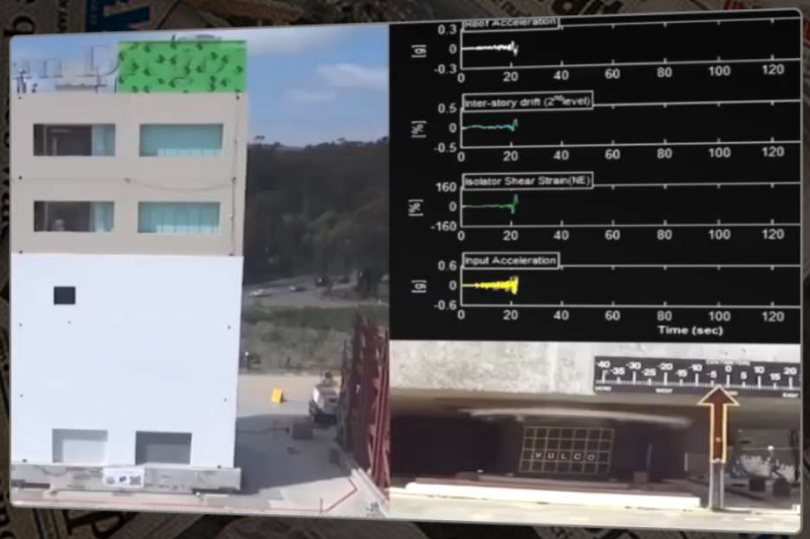
Unleash the strength of stability

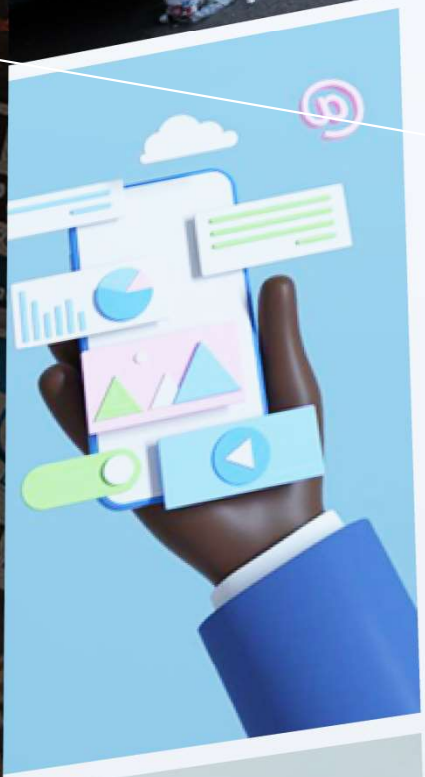


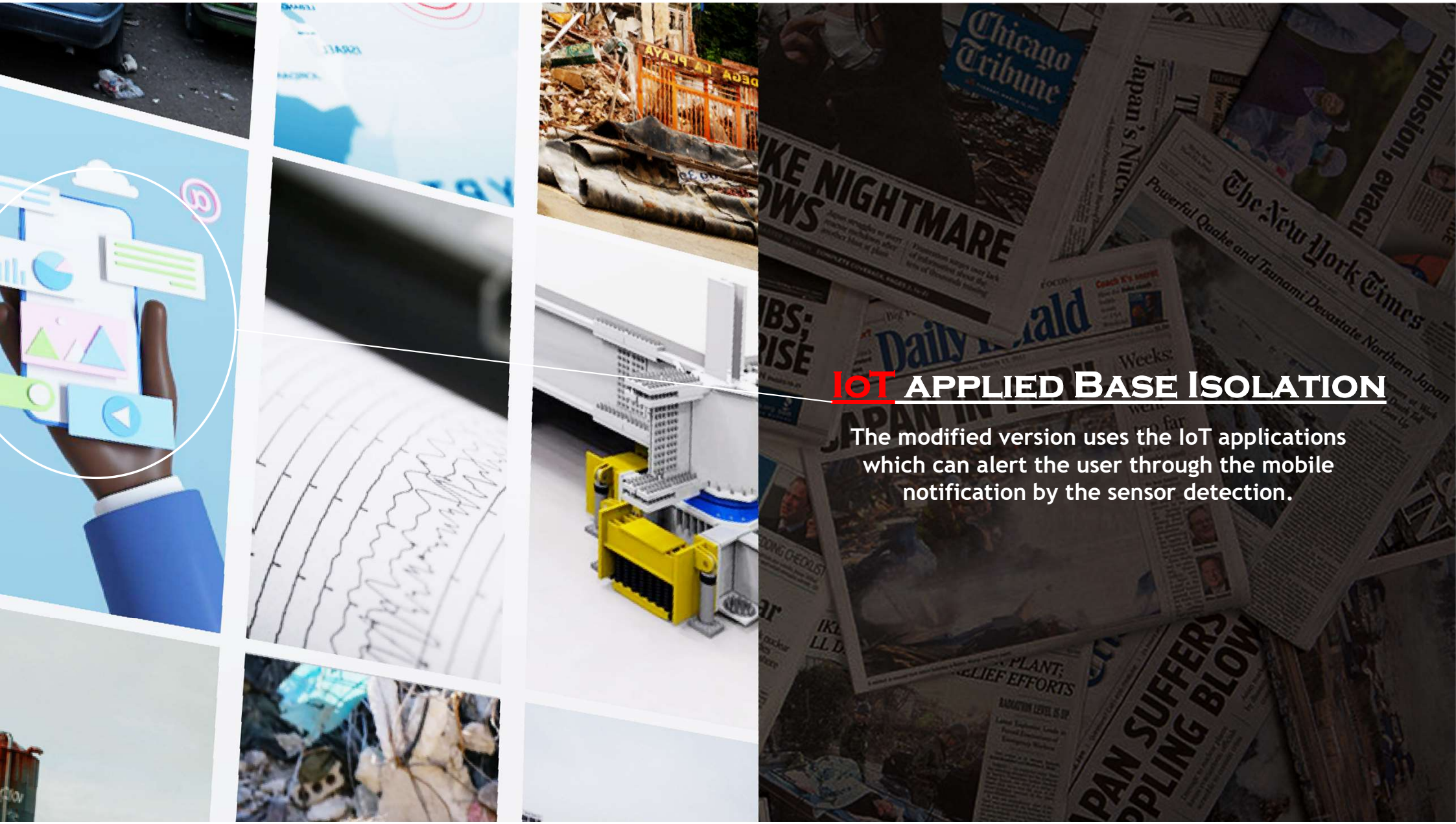
Secure your future with base isolation system

Base Isolation(BIS)

Base isolation is a method for moderating the effects of earthquakes on buildings. Isolator devices (either elastic or sliding) are installed between the foundation and the building superstructure.



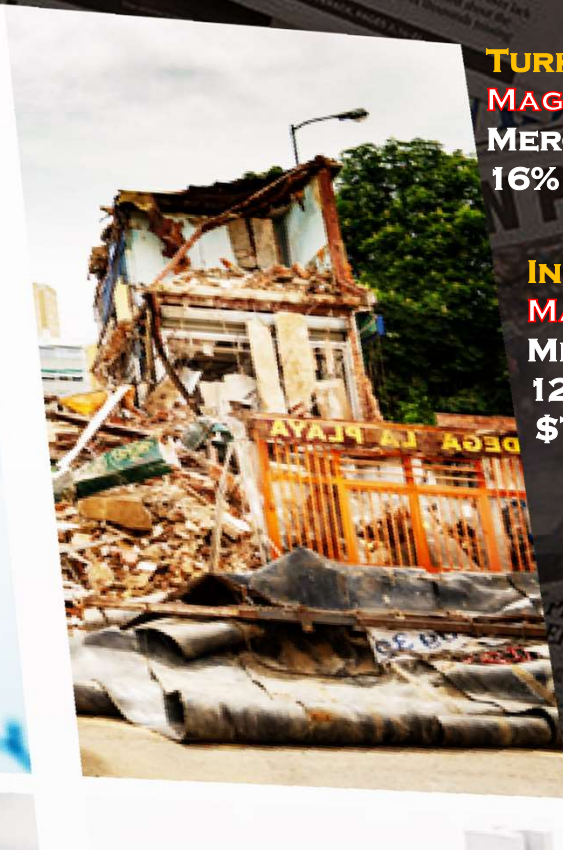




IoT applied Base Isolation

The modified version uses the IoT applications which can alert the user through the mobile notification by the sensor detection.

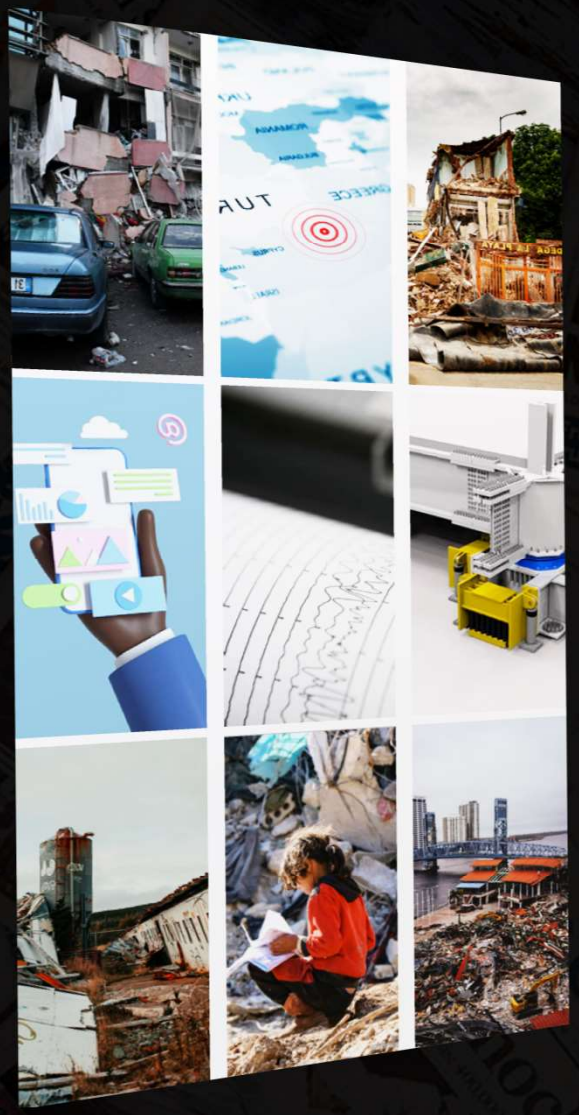
Quakes and Impacts with respect to Case - Study



Turkey(Syria) 2023
Magnitude level -7.5-7.8
Mercalli intensity of XII
16% of Turkey's population affected

Indonesia(Maluku) 2023
Magnitude level -7.5-7.6
Mercalli intensity of VI
121,540 people, 30,385 households,
$779 Million (USD) of infrastructure

Papua New Guinea 2022
Magnitude level -7.6
Mercalli intensity of VII
damaged buildings, killed 5 people

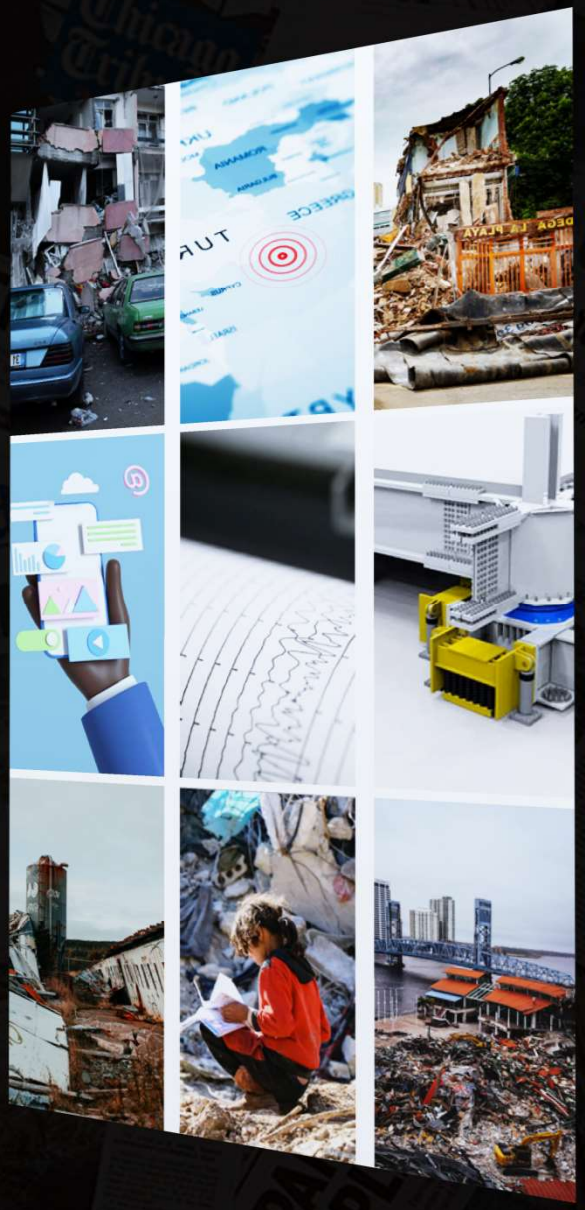


OBJECTIVES

- ✓ To minimize economic losses due to earthquake damage and provide a cost-effective solution .
- ✓ To increase the resilience and sustainability of buildings in earthquake-prone areas.
- ✓ To promote innovation and advancement in seismic protection technology.
- ✓ To ensure buildings remain functional and usable after an earthquake event.

Need of BIS

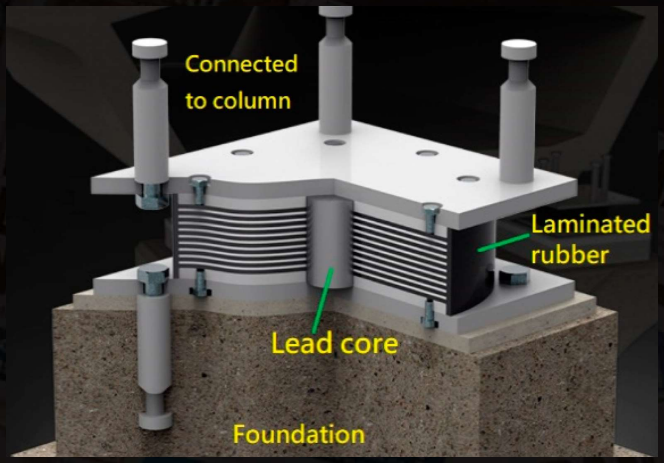
- ✓ By reducing the amount of seismic energy transmitted to the building, base isolation systems help to minimize the risk of damage and ensure the building remains safe and usable after the event.
- ✓ As the world experiences more frequent and intense earthquakes, and as populations continue to grow in earthquake-prone areas



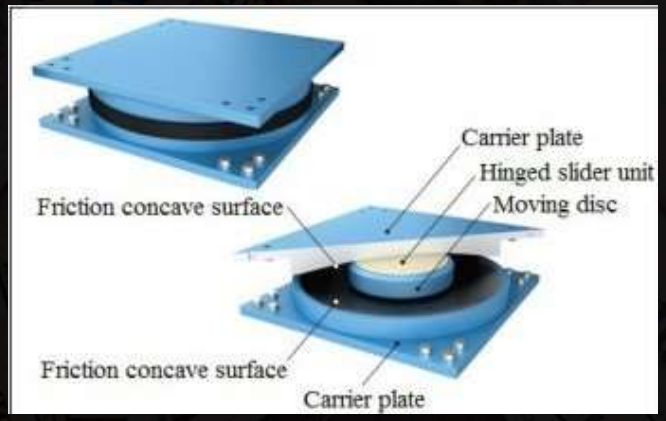
Various Stage of Development (BIS)

- ✓ First BIS was registered and patent in 1800's
- ✓ The first few buildings that used the BIS was in early 1900's Tokyo Imperial hotel, In which after the structural bearing commercially used in bridge construction.
- ✓ First material used was - LRB - Lead Rubber Bearing (High Flexibility & Damping)
- ✓ In early 1980's - HDR - High Damping Rubber (Effective damping over a wide range, highly resistant to fatigue and aging)
- ✓ For restoring force - FPS - Friction Pendulum System (Easy maintenance, for high-rise building and bridges)

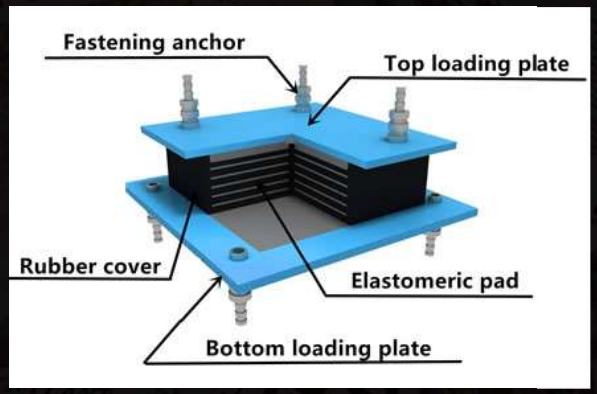
Commonly using types of BIS



1.Lead Rubber Bearing(LRB)



2.High Damping Rubber Bearing (HDRB)



3.Friction Pendulum System (FPS)

We're going to implement

PU Polyurethane - Solid Bar Elastic Damping Wear Resistant.

✓ Higher Elasticity, higher damping strength

Research journels (literature reviews)

NAME OF PROJECT	AUTHOUR/YEAR	SENSOR/BASE ISOLATION TYPE	DISCUSSION	INFERENCE	OBSERVATION
Earthquake Detection and Alert System for Base Isolated Buildings	2015 by Hadi Sadeghi and Mohammad Reza Sharifzadeh	Accelerometer and Geophone/ Laminated Rubber Bearings	The system was able to detect earthquakes and trigger an alarm to notify occupants.	Base isolation can help reduce the risk of damage to structures during earthquakes.	The system was tested in a laboratory setting and needs to be validated in a real-world scenario.
Development of a Wireless Sensor Network for Structural Health Monitoring and Seismic Detection	2012 by Jui-Sheng Chou and Chi-Hua Chen	Accelerometer	The wireless sensor network was able to detect seismic activity and provide real-time monitoring of structural health.	Structural health monitoring can help identify potential problems before they become critical.	The system was tested in a laboratory setting and needs to be validated in a real-world scenario.
'Smart' Base Isolation Strategies	H. Yoshioka, J. C. Ramallo, B. F. Spencer Jr.	Magnetorheological dampers	Magnetorheological dampers can adjust their damping properties in real-time, providing adaptive control to the base isolation system.	Smart base isolation strategies can effectively reduce the seismic response of structures and provide adaptive control to the base isolation system.	Magnetorheological dampers provide accurate and adaptive control,

Considerations for Implementation

- ✓ The suitability of base isolation depends on various factors like soil conditions, building height, shape, weight, and seismicity of the region.
- ✓ Buildings with shallow foundations or irregular shapes may not be suitable as they require significant modification to their foundation design to accommodate isolation devices.
- ✓ Torsional effects induced by buildings with cantilevers or long spans can lead to increased seismic forces on the building.
- ✓ While base isolation can be effective in reducing the effects of earthquake ground motion on structures, it may not be suitable for all types of foundations or buildings

Limitations & Challenges for Implementation

- ✓ Cost.
- ✓ Require regular maintenance.
- ✓ Retrofitting existing buildings can be difficult and expensive.
- ✓ Lack of awareness.
- ✓ Cultural resistance.
- ✓ Local seismicity.
- ✓ Building codes and regulations.

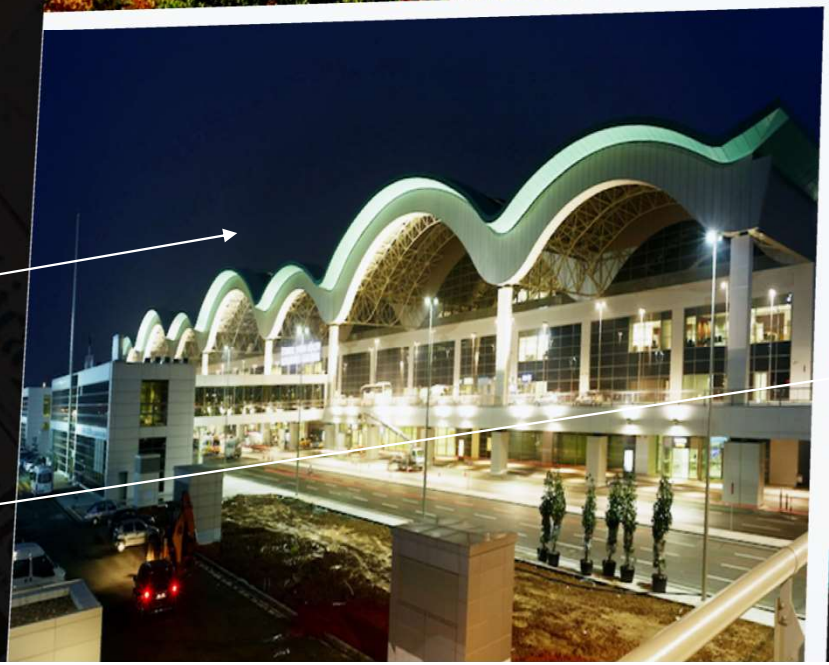
Largest Base-Isolated

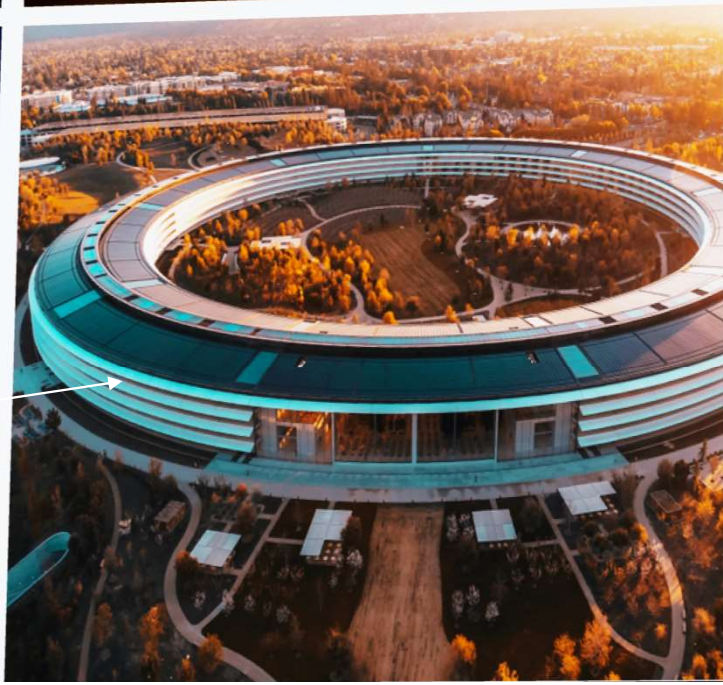
Buildings/bridges

Tan Tzu Medical Center

San Francisco Oakland Bay Bridge

Sabiha Gokcen Airport





Apple Park

MAHATMA GHANDHI SETU BRIDGE

INTEGRAL COACH FACTORY

WORLD TRADE PARK

SABARMATI RIVERFRONT

Structure	Location	Type of Isolation	Number of Bearings	Function
World Trade Park	Jaipur, India	Elastomeric Bearings	1,080	Allows the building to move horizontally and dissipate seismic energy.
Apple Park	Cupertino, California, USA	Customized Base Isolators	700	Absorbs seismic waves and reduces the building's response to ground motion during an earthquake.
Sabarmati Riverfront Development Project	Ahmedabad, India	High Damping Rubber Bearings	1056	Reduce the impact of seismic activity
Integral Coach Factory	Chennai, India	Lead Rubber Bearings	216	Absorbs seismic energy and reduces the impact of earthquakes on the building.
Logiport Sagamihara	Kanagawa, Japan	Seismic Isolation Bearings	1,968	Reduces the impact of earthquakes on the building and protects it from damage.
Mahatma Gandhi Setu Bridge	Patna, India	Seismic Isolation Bearings	232	Absorbs seismic energy and reduces the impact of earthquakes on the

				bridge.
Sabiha Gökçen Airport	Istanbul, Turkey	Seismic Isolation Bearings	1,688	Protects the building and its occupants from the effects of seismic activity.
San Francisco - Oakland Bay Bridge	California, USA	Seismic Isolation Bearings	368	Absorbs seismic energy and protects the bridge from damage during an earthquake.
Shinagawa Season Terrace	Tokyo, Japan	Seismic Isolation Bearings	596	Reduces the impact of seismic waves on the building and protects it from damage.
Tan Tzu Medical Center	Taichung, Taiwan	Seismic Isolation Bearings	246	Protects the building and its occupants from the effects of seismic activity.
Tokyo Skytree	Tokyo, Japan	Seismic Isolation Bearings	36	Absorbs seismic energy and reduces the building's response to ground motion during an earthquake.
				Allows the building to move horizontally and


QUAKE-PROOF
Google - ShakeAlert® · now
Earthquake nearby
Expect shaking. Est magnitude 6.1 about
16 miles away.
THE ALERT APPLICATION

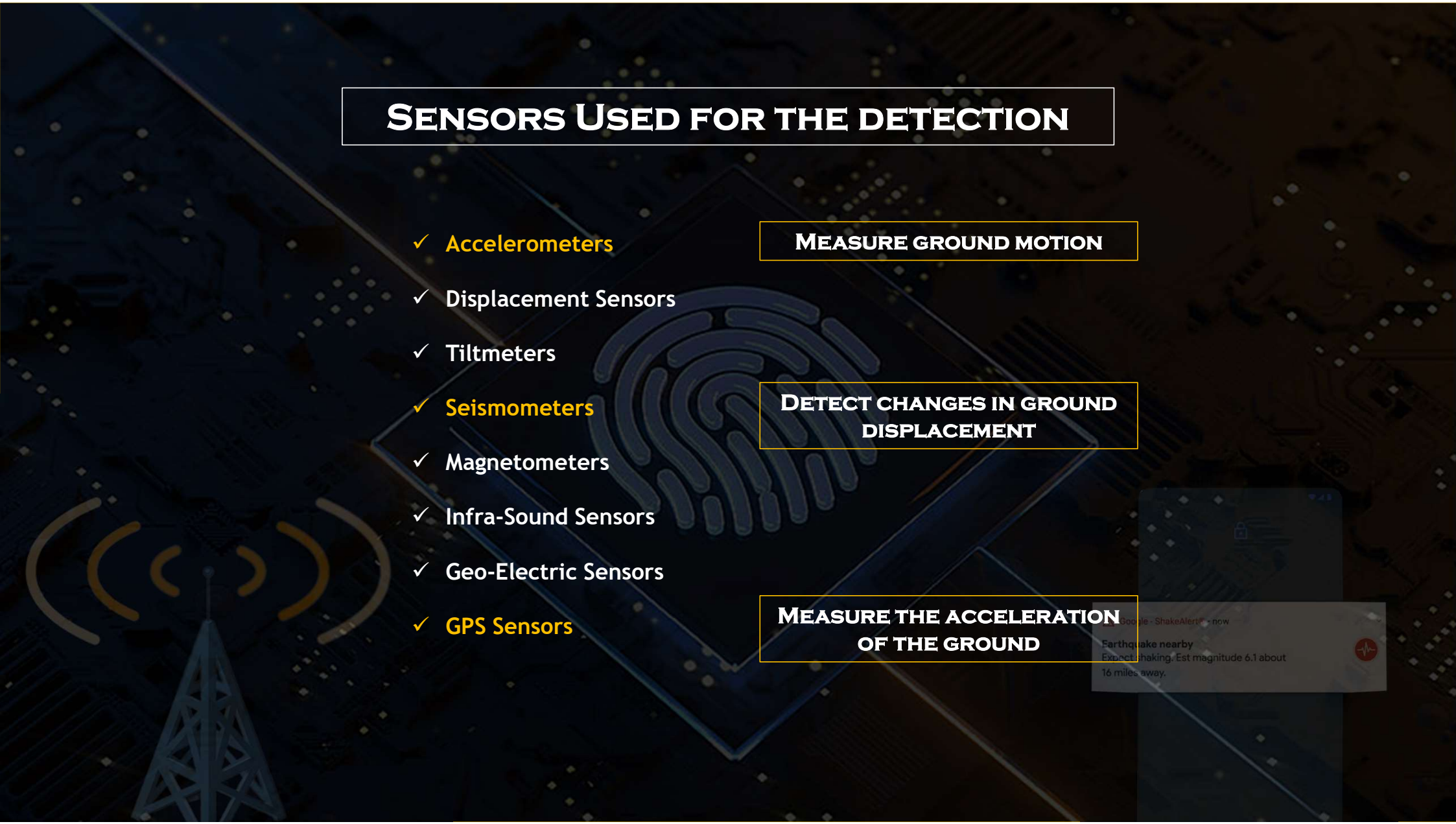
Sensors Used for the detection

- ✓ Accelerometers
- ✓ Displacement Sensors
- ✓ Tiltmeters
- ✓ Seismometers
- ✓ Magnetometers
- ✓ Infra-Sound Sensors
- ✓ Geo-Electric Sensors
- ✓ GPS Sensors

Measure ground motion

Detect changes in ground displacement

Measure the acceleration of the ground



Resilient through Time

Location - Some structures were built on solid bedrock, while others were built on gently sloping hillsides that absorb seismic waves.

Building Materials - Structures built with flexible materials can withstand earthquakes better than rigid materials.

Design - Many ancient monuments and temples were built with features and minimize the impact of seismic waves.

Cultural Beliefs - In some cases, cultural beliefs played a role in protecting ancient monuments and temples from earthquakes

THANK YOU