# *San Giorgio bridge dashboard*

IoT Project 2020/21 – Bridge Digital Twin

**Authors:**

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# Objectives

- ***The main objective :***
  - Designing a prototype of an IoT system that is able to implement a Digital Twin of a monitored bridge called “San Giorgio”.

- ***Digital Twin Advantages:***
  - Enhancing asset performance
  - Helping actors anticipate adverse environmental effects during the life cycle stages
  - Forecasting maintenance activities based on sensor data
  - Bringing further benefits for built asset all across the globe

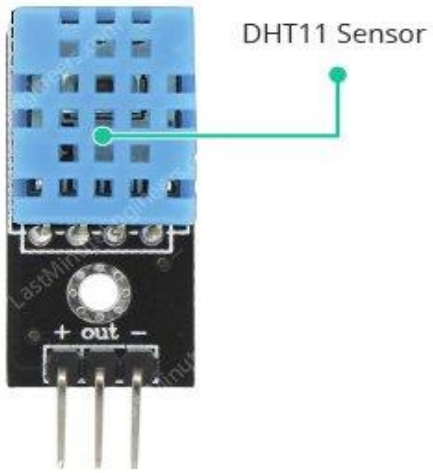
# Network of Sensors

- Network of sensors installed on each pile of the bridge
- Sensors data obtained help defining the conditions of the bridge structure and the environment around


- Sensors data will be sent over the internet via Zigbee Wifi technology
- ZigBee: low-cost, low-power, wireless mesh (star/tree) network standard

# Network of Sensors

*Adafruit Anemometer*



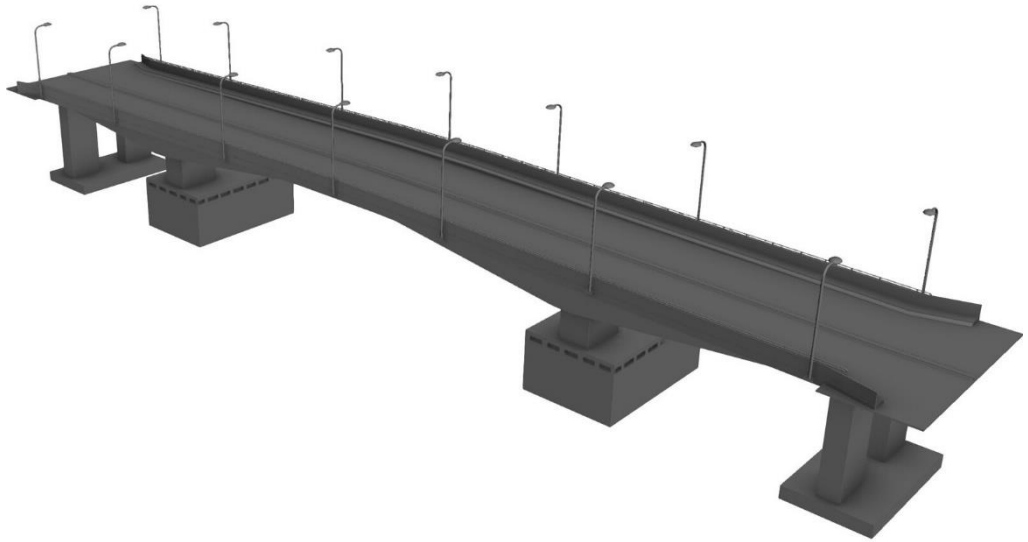

*DHT11 Sensor*


*Rain Sensor*


*Force Sensors (FSRs)*

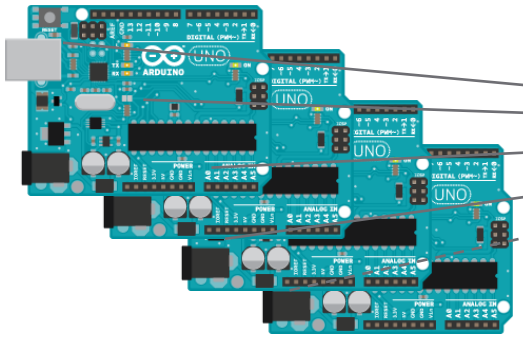
# Limitations

- 4 piles
- Arduino simulated using Tinkercad
- Sensor values auto-generated in client NodeJS application



# System architecture

- *Anemometer*
- *DHT11 Sensor*
- *Rain Sensor*
- *Force Sensor*



**x 18**

mqtt out

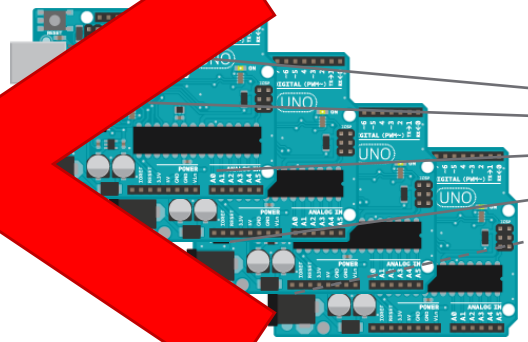
mqtt in

**ExpressJS**

**Websocket**

# Simulated system architecture

- *Anemometer*
- *DHT11 Sensor*
- *Rain Sensor*
- *Force Sensor*



**x 18**

mqtt out

mqtt in

**ExpressJS**

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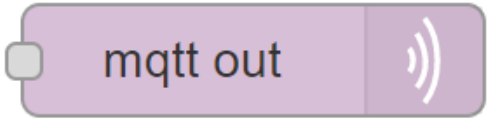
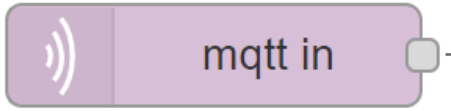
# Simulated system architecture

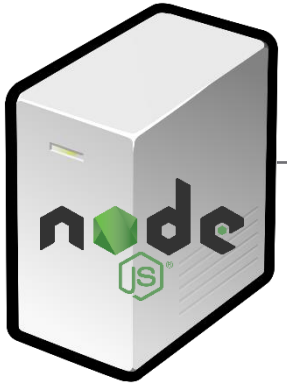
*Pressure (0-600 Kpa)*
*Wind speed (0-150 m/s)*
*Air temperature (0-150 °C)*
*Air Humidity (0-100 %)*
*Rain (0-300 mm/day)*


***Broker:*** *mqtt://test.mosquitto.org*

***Topic:*** *unige/iot/twinbridge-karsifi-cadri*



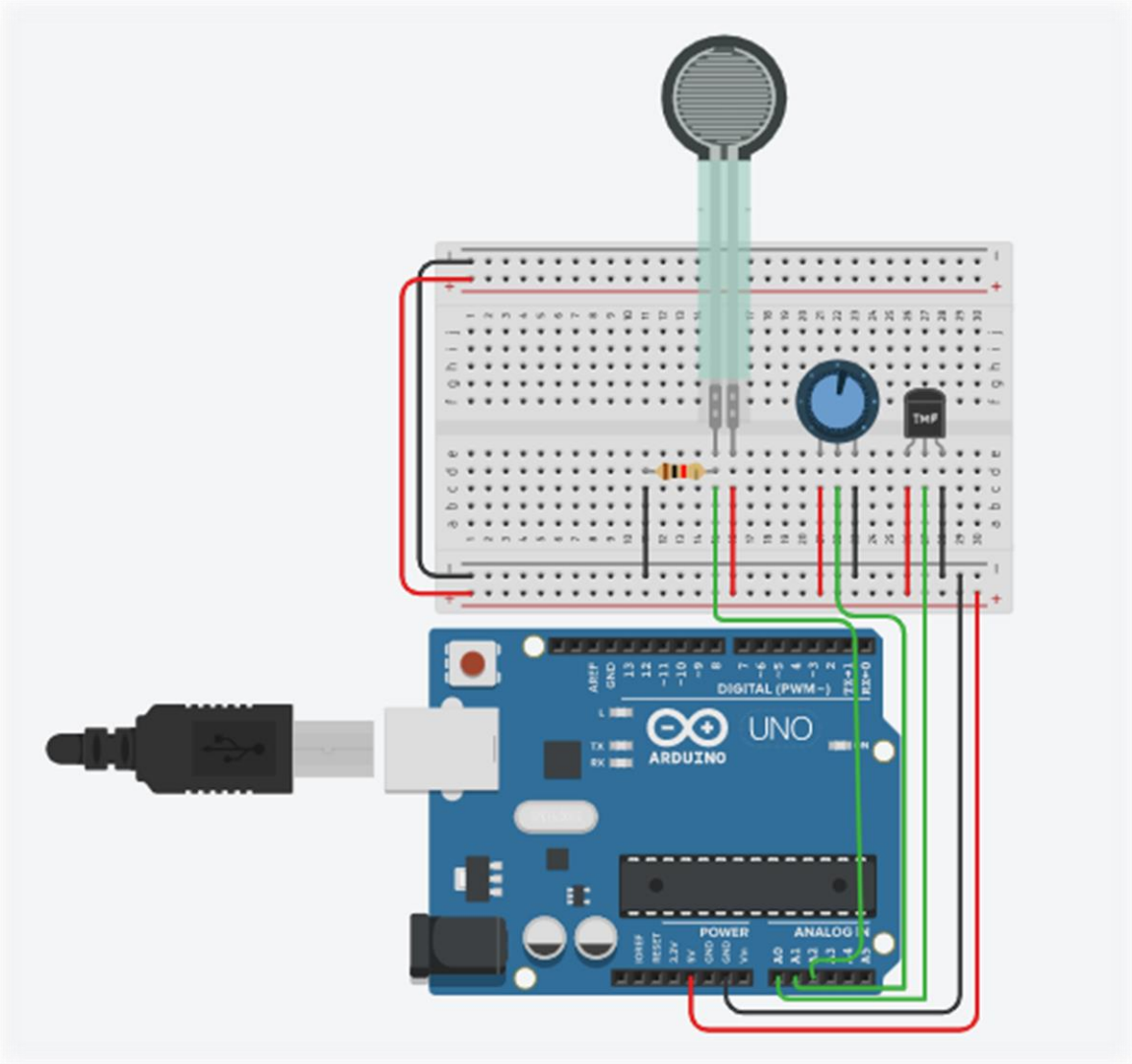




**ExpressJS**

**Websocket**

*socket.io*

# Arduino code




- ***Force Sensor***
- ***Potentiometer***
- ***Temperature sensor***

# Server side libraries

- Express API framework: https://expressjs.com/

```
app.get('/home', function (req, res) {

});
```

- EJS: https://ejs.co/

```
res.render('index.html', { ejs: "IoT" });
```

```
<div>
    <%= ejs %>
</div>
```

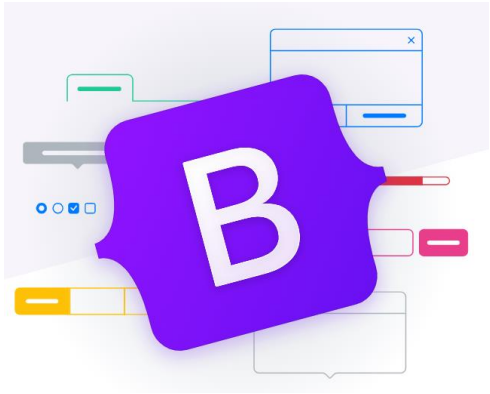
- fs: read/write alert settings

- MQTT: https://github.com/mqttjs/MQTT.js


- Socket.io server library: https://socket.io/

# Client-side libraries

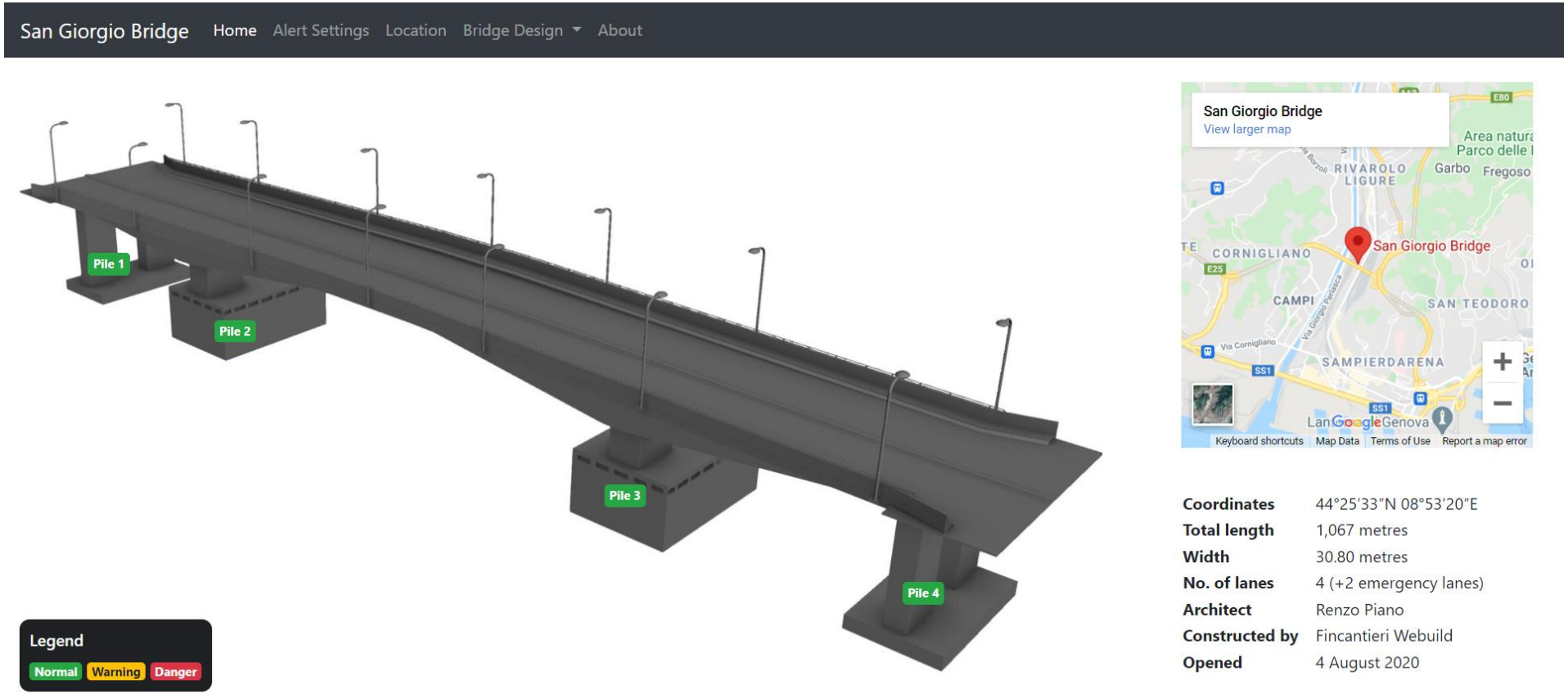
- Bootstrap: https://getbootstrap.com/



- jQuery: https://jquery.com/

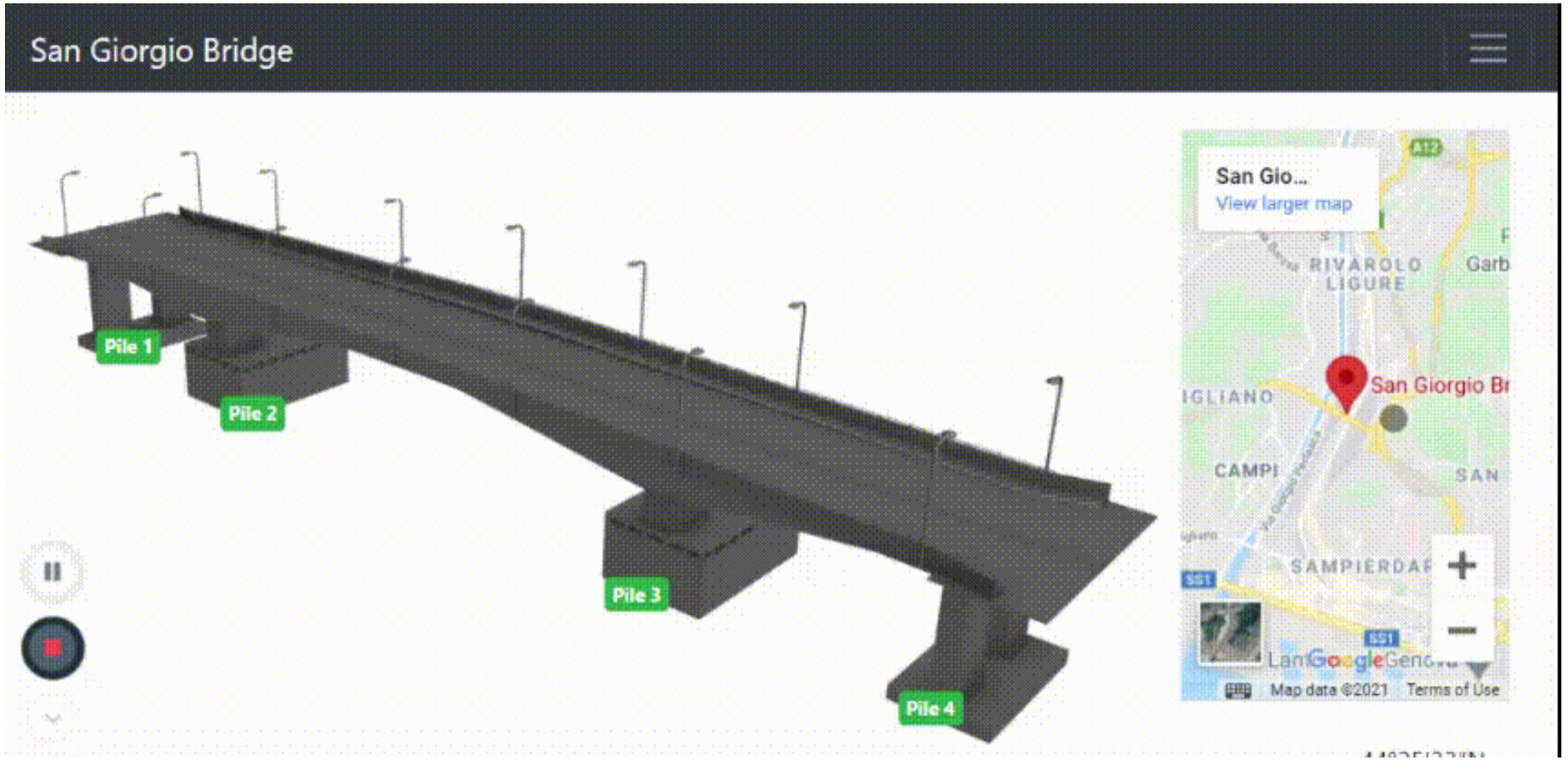
- Socket.io client library

# Demo

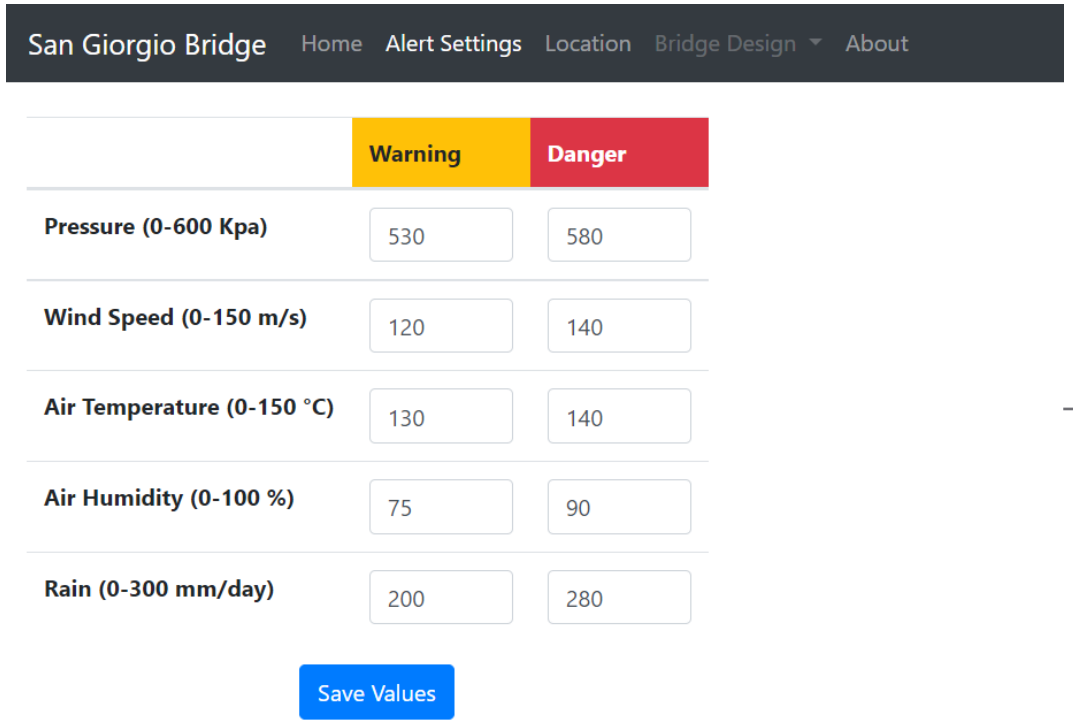



| | |
|---|---|
| **Coordinates** | 44°25′33″N 08°53′20″E |
| **Total length** | 1,067 metres |
| **Width** | 30.80 metres |
| **No. of lanes** | 4 (+2 emergency lanes) |
| **Architect** | Renzo Piano |
| **Constructed by** | Fincantieri Webuild |
| **Opened** | 4 August 2020 |

# Demo


San Giorgio Bridge
Pile 1
Pile 2
Pile 3
Pile 4
San Gio...
View larger map
RIVAROLO LIGURE
IGLIANO
CAMPI
SAMPIERDAR
San Giorgio Br
Map data ©2021
Terms of Use

# Demo




fs


```
{
  "pressure": {
    "warning": "530",
    "danger": "580"
  },
  "wind": {
    "warning": "120",
    "danger": "140"
  },
  "temperature": {
    "warning": "130",
    "danger": "140"
  },
  "humidity": {
    "warning": "75",
    "danger": "90"
  },
  "rain": {
    "warning": "200",
    "danger": "280"
  }
}
```

# Demo

San Giorgio Bridge Home Alert Settings Location Bridge Design About

## San Giorgio bridge dashboard

Designed and developed by:

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***Unige - IOT 2020/21 Project: Bridge Digital Twin***