BROKERAGE EVENT
ICTURKEY
2019ISTANBUL

University of Rome "Tor Vergata"

Donato Abruzzese

abruzzese@uniroma2.it

Description of the Organization

The University of Rome Tor Vergata was established in **1982**: it is a relatively young University. It stretches on 600 hectares and hosts important research institutions, such as CNR and the Italian Space Agency - ASI. Total student population about **40.000 students**. University of Rome Tor Vergata is structured in **6 Schools** (Economics; Law; Engineering; Humanities and Philosophy; Medicine and Surgery; Mathematics, Physics and Natural Sciences) which are organised in 18 Departments. Tor Vergata offers **107 degree courses** (bachelor, master and single cycle degree) and **31 PhD courses** (taught in Italian or English). Tor Vergata is keen to sharpen its worldwide profile and offers 19 courses taught in English (6 double/joint degree programmes). Tor Vergata teaching encompasses **150 post lauream courses** (advanced training courses, 1st and 2nd Level Vocational Master) and 50 Specialisation Schools

Description of the your research interest

- The research team is composed by 5 professors, 1 PhD expert, 2 PhD candidate, 5 Ms graduate P.E. former students, 4 Ms student in civil engineering and electronic engineering.

- The team is very interested in develop technologies able to monitor and control civil engineering structures under high and critic loads (strong wind, earthquake, impact, explosion…) collecting day by day all the information which can give the continuous picture of the health of the structure..

Project Idea

Horizon 2018/20 Innovation

IoT technology for the Health Structural Monitoring

- Objectives:
  - to assess permanently the health of the structure through embedded monitoring
  - to define and realize affordable devices in order to achieve the continuous health of the structure
  - to realize a tailored network in order to collect all these data and elaborate it

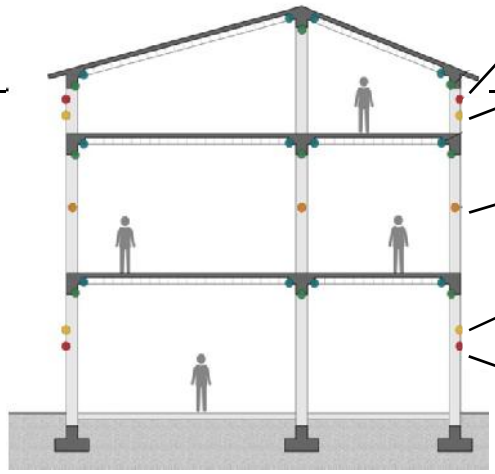
- Expected results

  - to indentify the right family of sensors able to perform the expected results and fulfil the previous objectives
  - to apply the monitoring system to some new building to be built and verify the result as case study

Earthquake damage to the building,
often due to the material decay
and lack of maintenance

High costs and much time for repairing and reconstructing

The buildings' structural safety today is for save money (maintenance, durability, efficiency) and to save life in the extreme environmental or anthropic actions



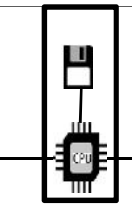
ACCELERATION
Structure-integrated accelerometers for monitoring the dynamic response.

STRAIN / STRESS
Monitoring of local stresses by means of strain gauges installed inside the structural members.

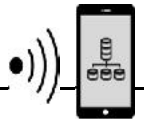
TEMPERATURE
Monitoring of the temperature inside the structural members for system calibration.

HUMIDITY /pH
Measurement of humidity and acidity of concrete to assess the risk of oxidation/corrosion.

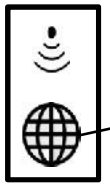
OXIDATION
Monitoring of the level of oxidation of steel bars in reinforced concrete.



LOCAL WIRELESS CONNECTION

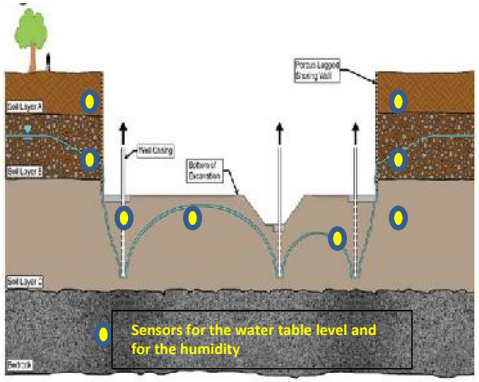


Local archive:
All sensors are connected to the monitoring system by a WiFI connection. Immediate and systematic check with portable WiFi devices during inspections on-site

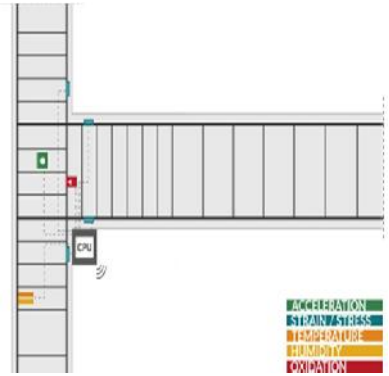


REMOTE WIRELESS CONNECTION

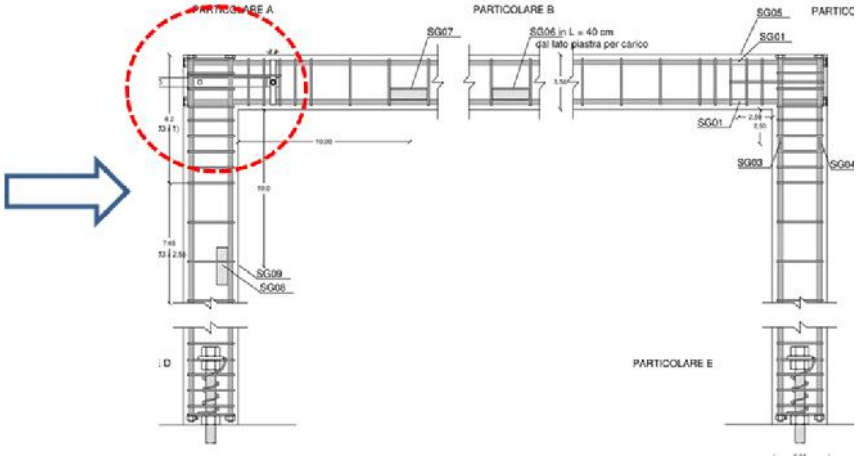
The system is permanently connected to the internet
Cloud database data transfer



Permanent control, also after built the foundations and the retaing walls, of the water table under the raft and behind the bulkhead. The monitoring system will give information also on the seasonal excursion of the water level, and on the occasional leakage from the pipelines, as well as on the situation during possible flooding.



Permanent monitoring
at critical points of the structure, in order to give a continuous information of the stress level due to the acting loads and of the behaviour of the structure to the external events.



GOAL

A structural safety monitoring system, other than detecting the presence of structural damage, and thus assessing the serviceability of the building after ordinary or exceptional events, it can provide objective data on the vulnerability, or even just on its current conditions, by evaluating the *stress state*, the *dynamic response*, and the *integrity of structural materials.*

BROKERAGE EVENT ICTURKEY 2019ISTANBUL

THE SYSTEM

The monitoring system is realized during building erection by installing a number of sensing devices (sensors), which are suitable to measure the physical quantities of interest, in order to estimate the current state of materials and, consequently, the actual strength of structural members, with the aim of assessing the overall safety of the building.

The operating monitoring system is integrated in the structure since the beginning of its life cycle, with sensors installed in the most important locations, and data-collection devices able to transfer remotely the values measured inside structural elements.

Each data-collection device, appearing as a small box placed on a beam or a pillar, is connected to a subset of sensors, those placed at the closest reference locations, and it is connected by a local network to the main data-processing unit.

The system can be considered as an Internet of Things (IoT) applied to building structures

Comments

- The large quantity of collected data every day, month, year, in long term will be an extraordinaire archive source of information in order to follow the continuous behavior of the structure, including specific event, earthquake, vibrations,overload…
- Following the behaviour of the structure it possible to analize, offline, the life evolution and changes of the structure, in order to analyze and understand in detail the cyclic events, and provide earlier countermeasure in degenerative situations.

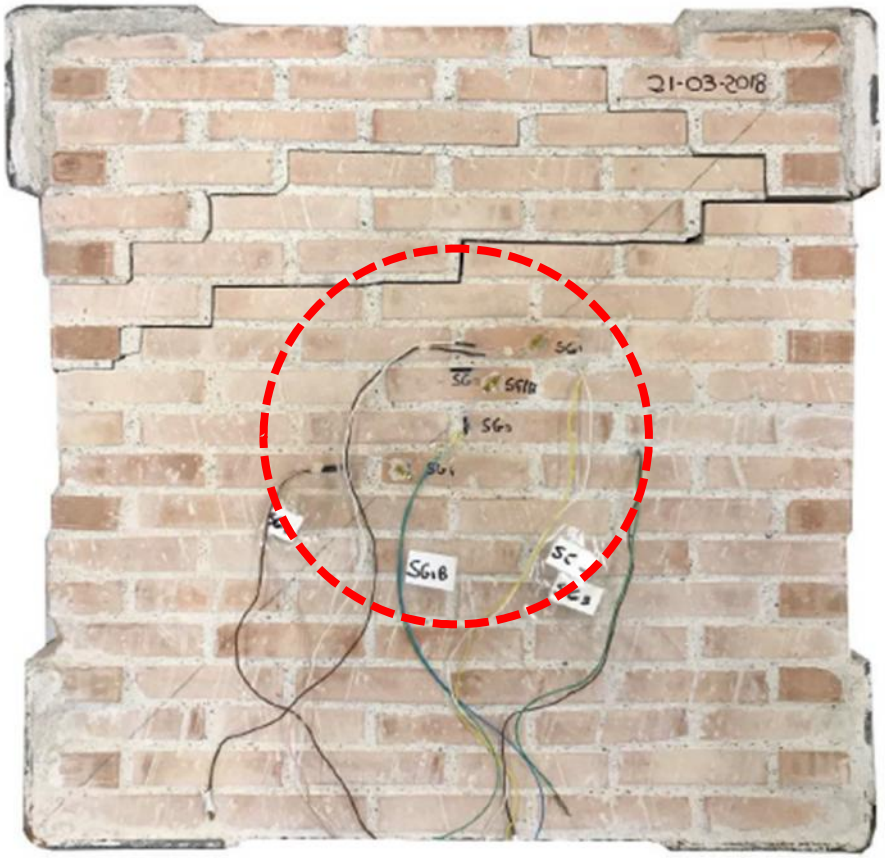
ADVANTAGES

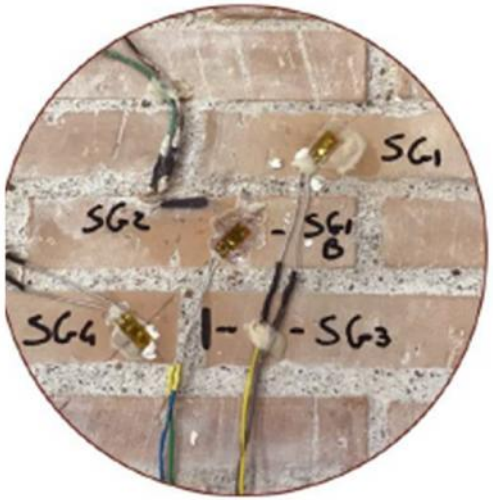
-Great control on whole structure, by using tailored, specific and smart software;
-optimization of the maintenance activity
-Increasing the safety level
- Alarm signal or alert at the critical state, as well as standard condition
-Negligeable installation and maintenance cost for the monitoring system, encouraging large diffusion of the system

An approximate evaluation of the cost for this kind of monitoring system range between 1-2 % of the total cost of the building, but involves more important economic gain, considering the non-stop activity and the more effective maintenance.

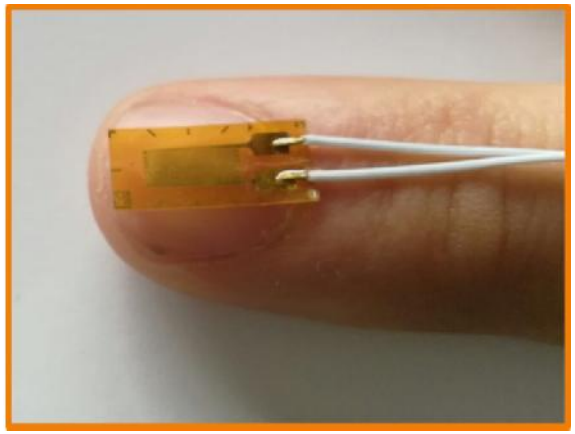
Protecting and monitoring also Cultural Heritage Monument

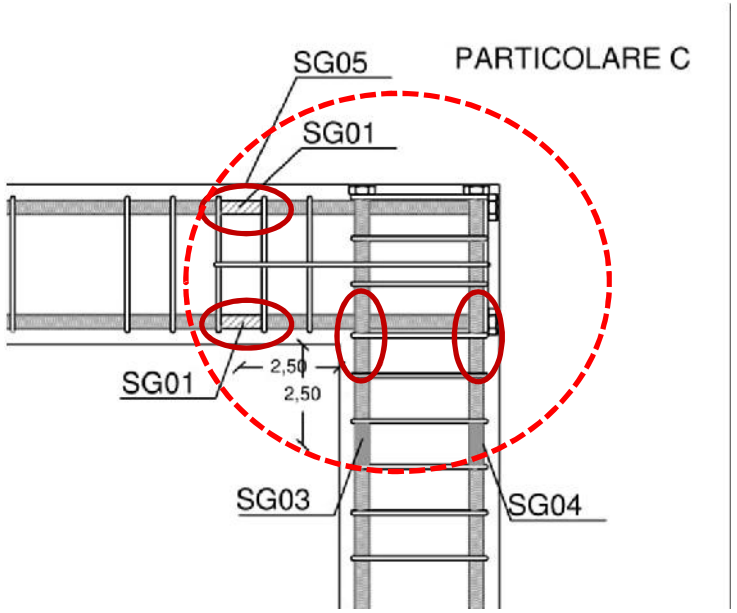
BROKERAGE EVENT
ICTURKEY
2019ISTANBUL





PERMANENT MONITORING

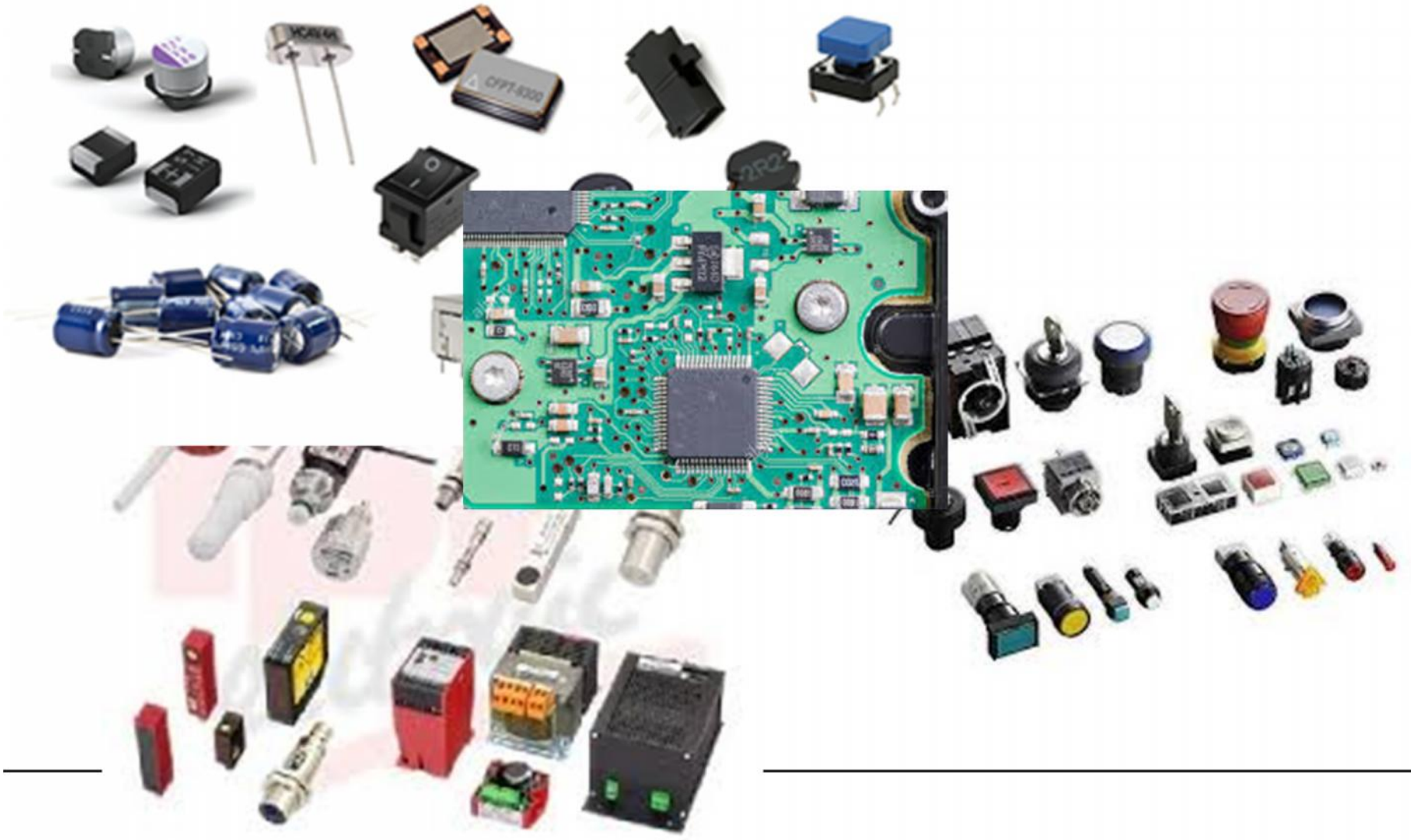


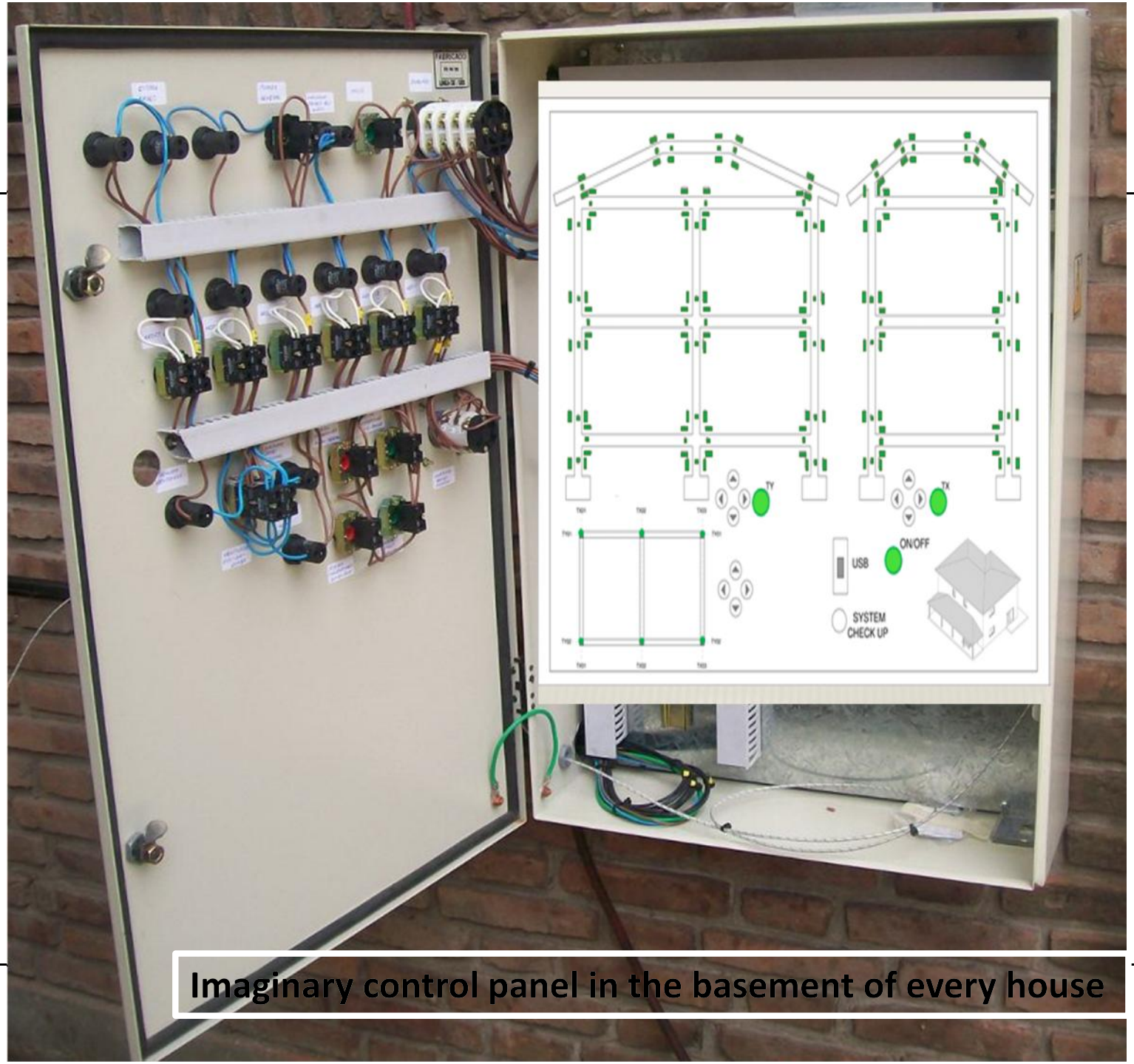


I o T - *Internet of (every)Thing*

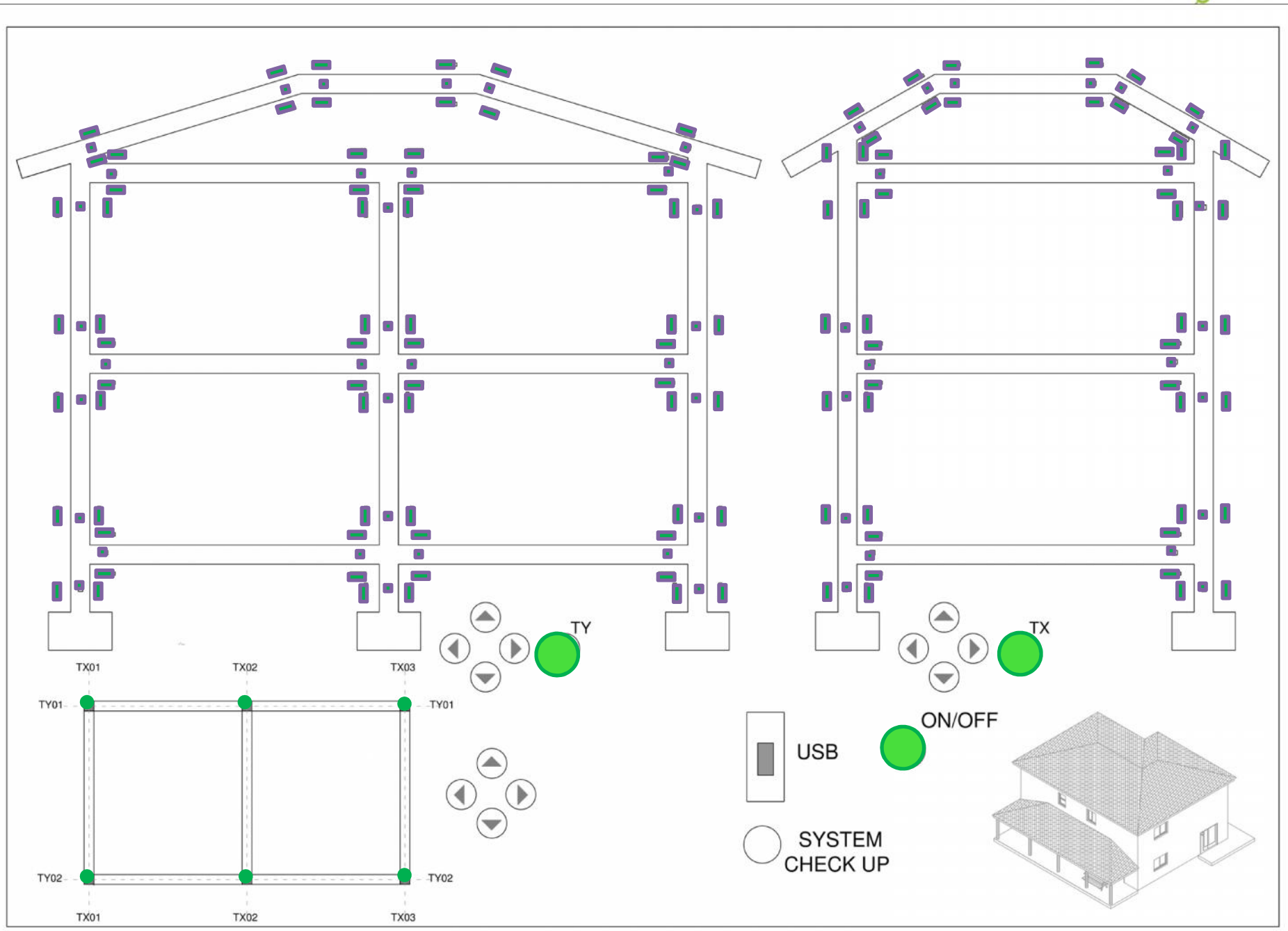
ELECTRONIC MINIATURIZED COMPONENT AVAILABLE AND CHEAP ($$)

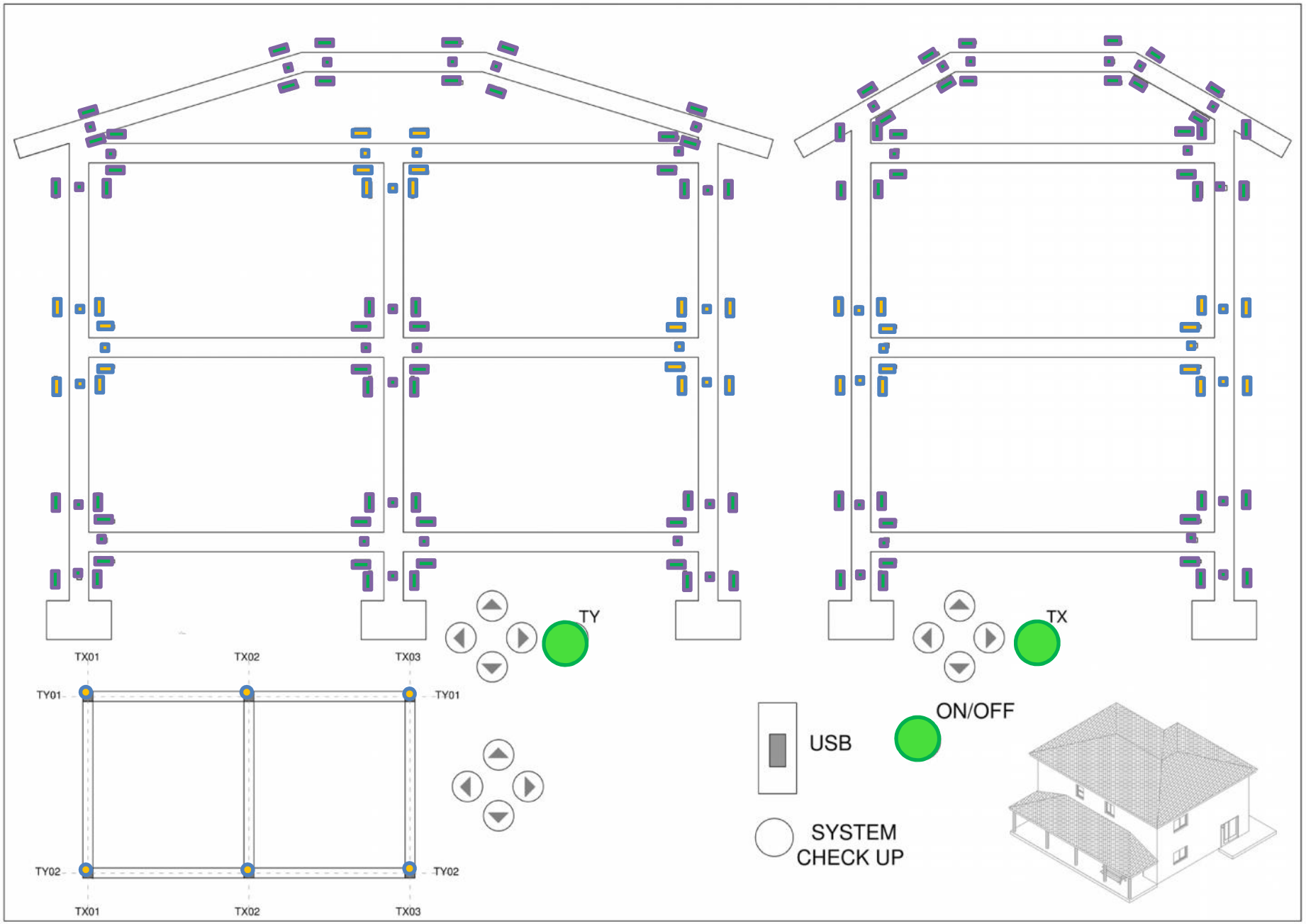
BROKERAGE EVENT
ICTURKEY
2019ISTANBUL

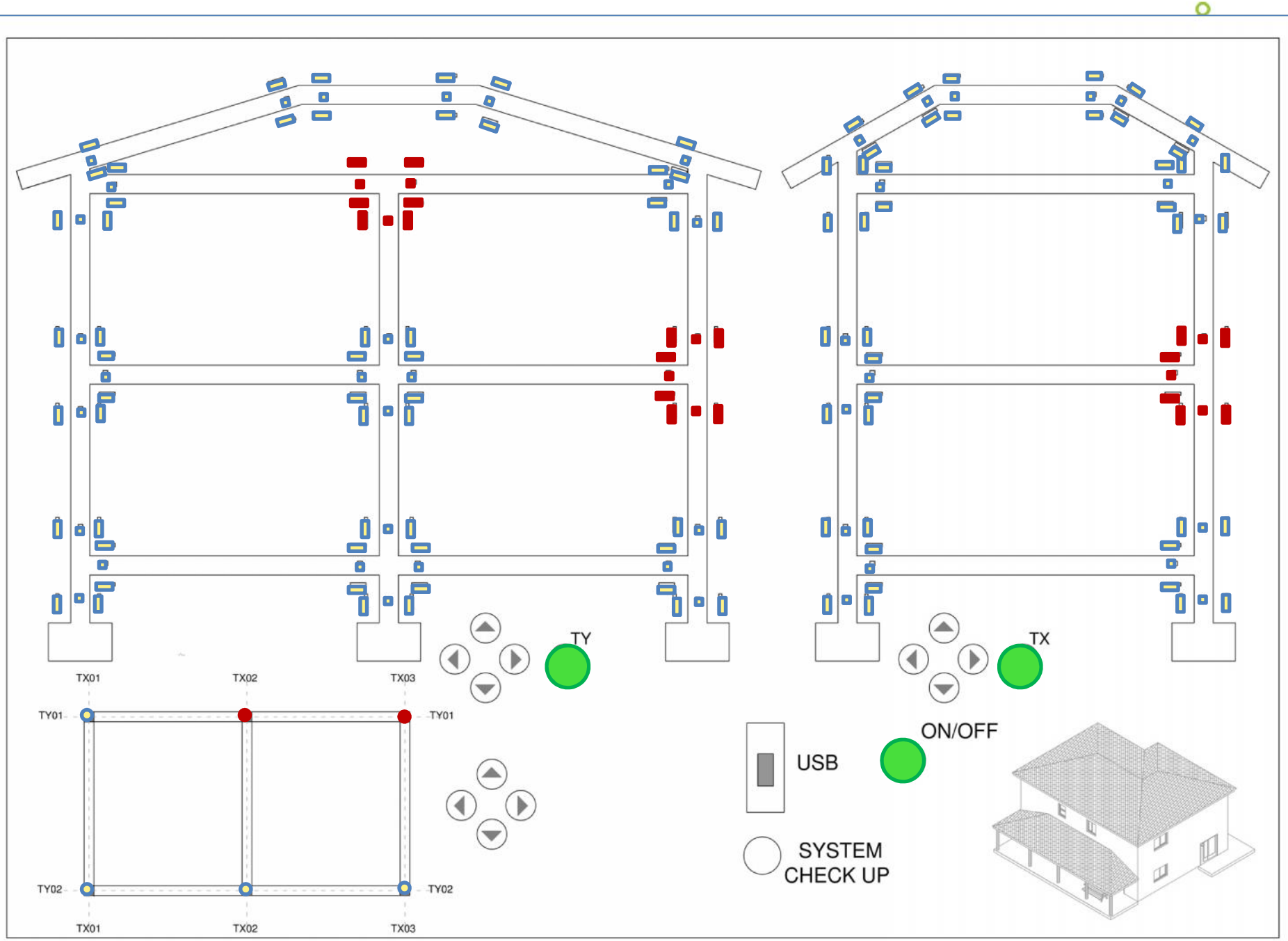




Imaginary control panel in the basement of every house


TY
TX
TX01
TX02
TX03
TY01
TY01
TY02
TY02
TX01
TX02
TX03
USB
ON/OFF
SYSTEM
CHECK UP


TY
TX
TX01
TX02
TX03
TY01
TY01
TY02
TY02
TX01
TX02
TX03
USB
ON/OFF
SYSTEM
CHECK UP


TY
TX
TX01
TX02
TX03
TY01
TY01
TY02
TY02
TX01
TX02
TX03
USB
ON/OFF
SYSTEM
CHECK UP

SMART BUILDING -> *SAFE BUILDING*

! Acknowledgment to happy research team !

BROKERAGE EVENT
ICTURKEY
2019ISTANBUL

Consortium - required partners

BROKERAGE EVENT
ICTURKEY
2019ISTANBUL

No	Expertise	Type	Country	Role in the project
01	Iot expert	RTD		wishing to apply IoT to civil engineering structures (building, bridges…)
02	Civil engineer/architect	SME		wishing to contribute in coordinating experimental test on full scale
03		IND		
04				
05				
06				
07				
08				

BROKERAGE EVENT
ICTURKEY
2019ISTANBUL

Donato Abruzzese

University of Rome “Tor Vergata”

Department of Civil Engineering & Computer Science

Italy

(+39) 06 72597003

E-mail abruzzese@uniroma2.it

web.uniroma2.it