# A smartphone application for supporting the data collection and analysis of the Cultural Heritage damaged during natural disasters

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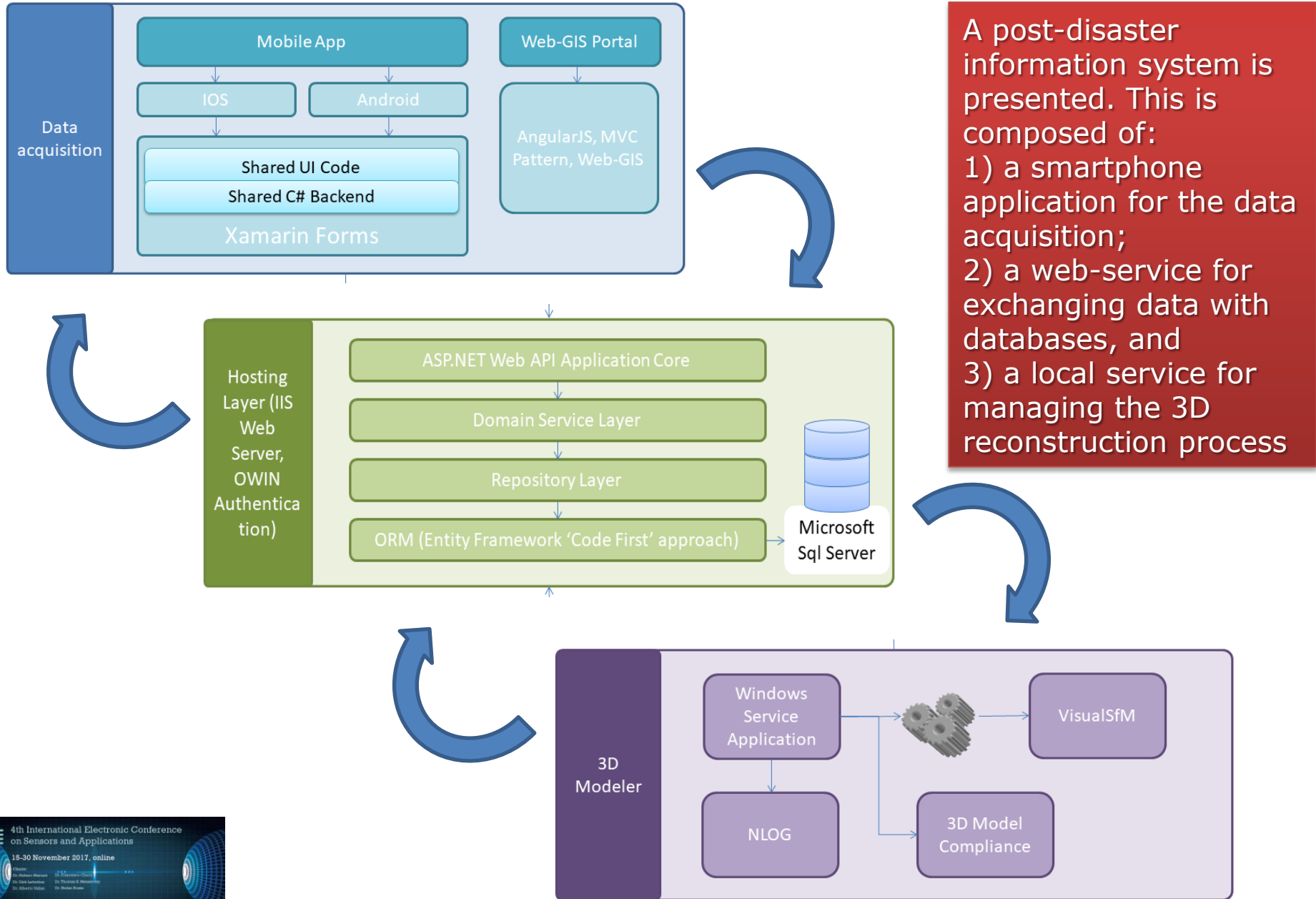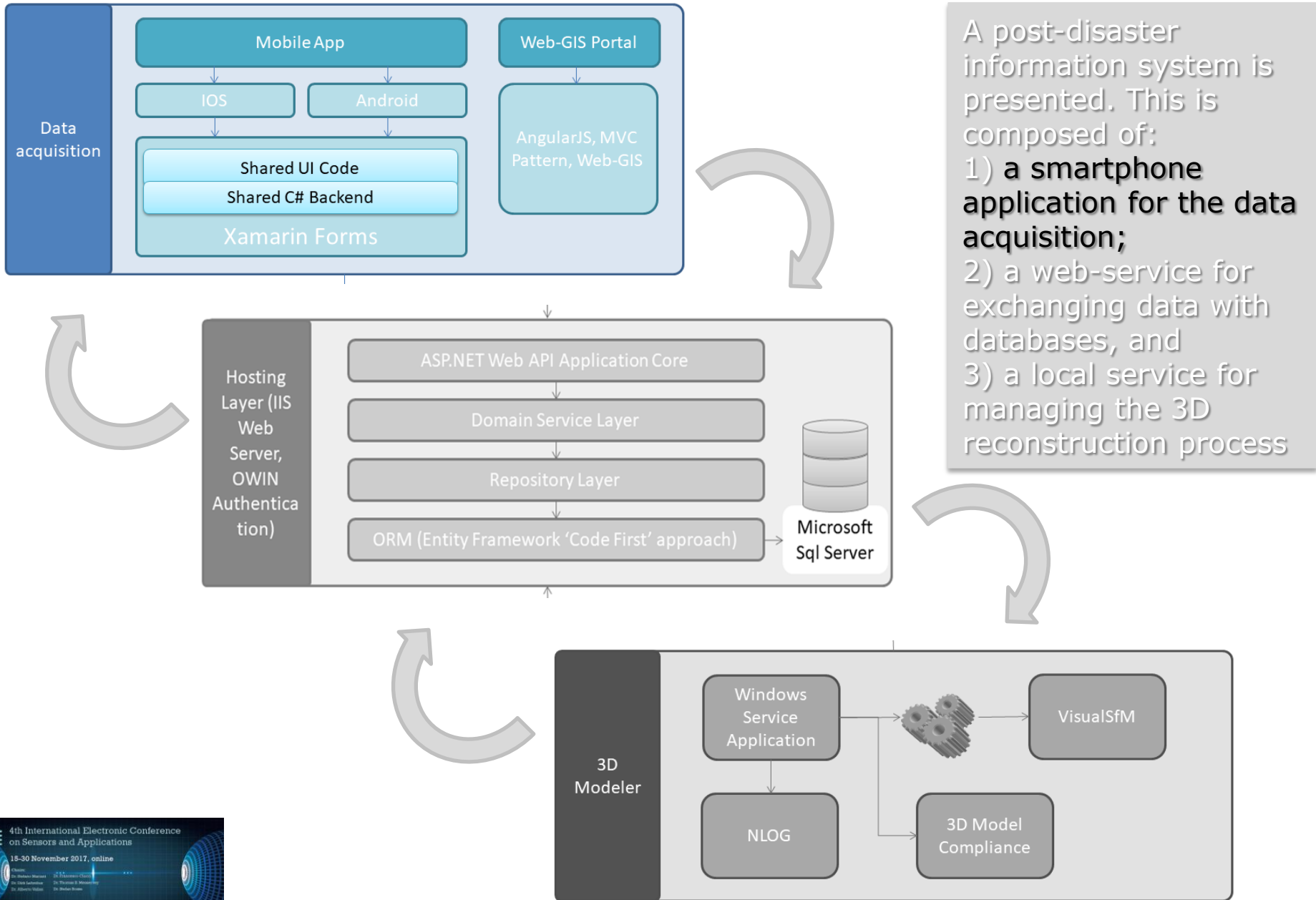
**Istituto Nazionale di Geofisica e Vulcanologia**

UNIVERSITÀ DELLA CALABRIA

DIPARTIMENTO DI MATEMATICA E INFORMATICA

# Architecture overview



**Data acquisition**
- Mobile App
  - IOS
  - Android
  - Shared UI Code
  - Shared C# Backend
  - Xamarin Forms
- Web-GIS Portal
  - AngularJS, MVC Pattern, Web-GIS

**Hosting Layer (IIS Web Server, OWIN Authentication)**
- ASP.NET Web API Application Core
- Domain Service Layer
- Repository Layer
- ORM (Entity Framework 'Code First' approach)
- Microsoft Sql Server

**3D Modeler**
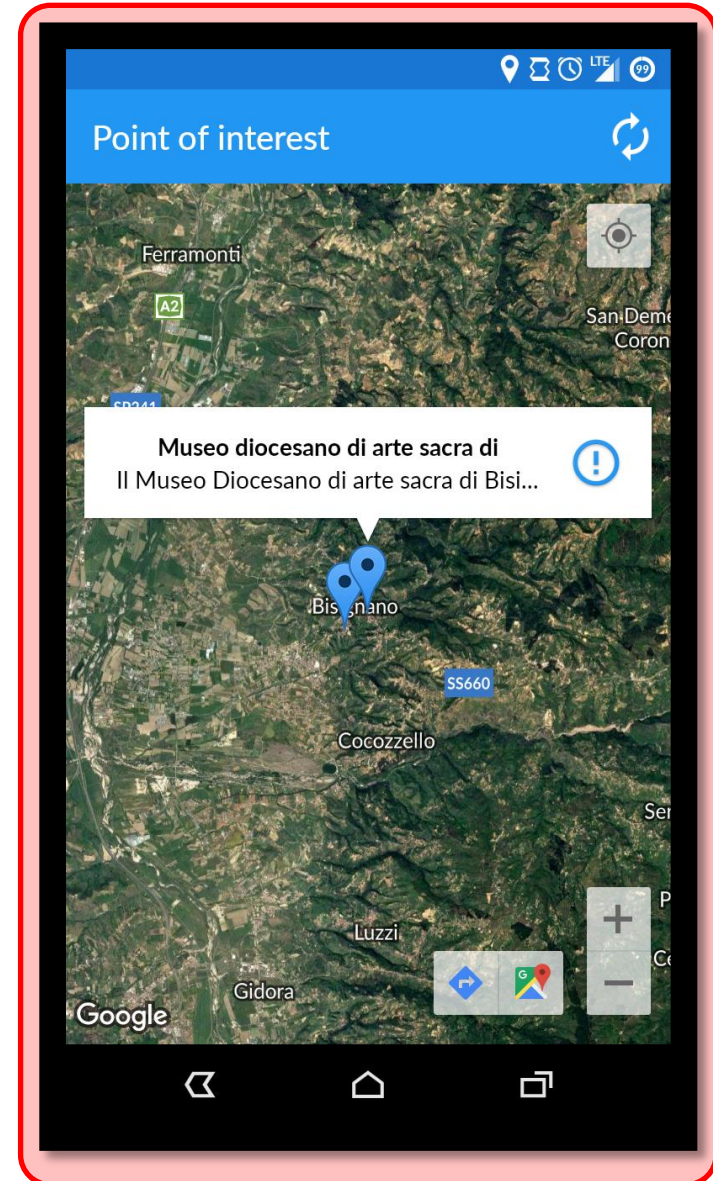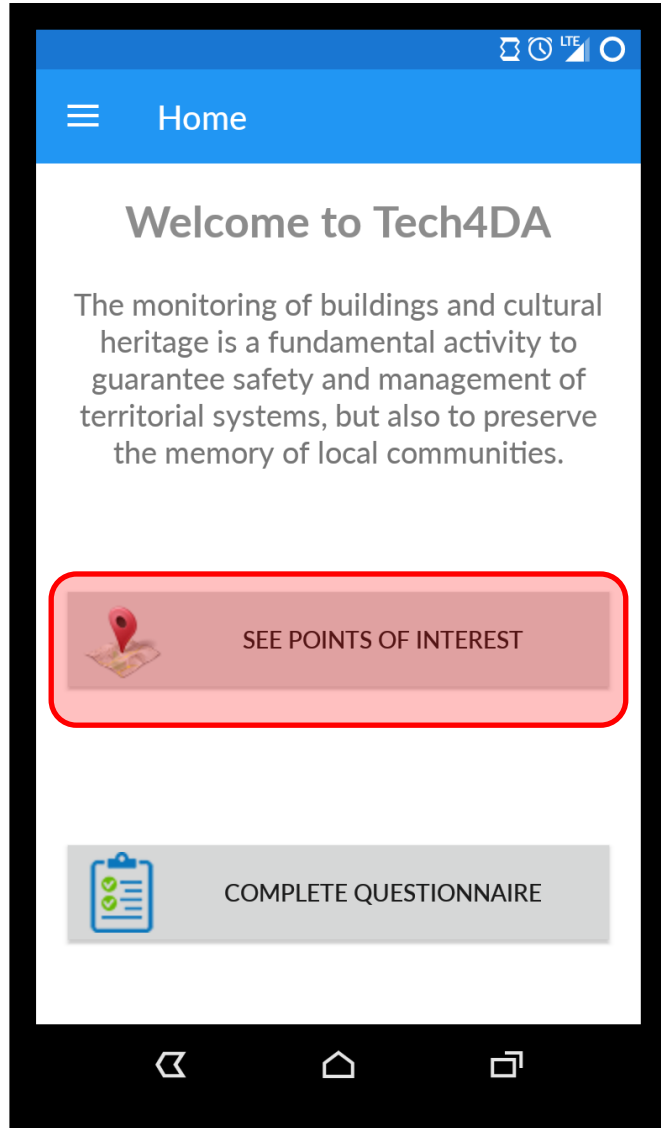- Windows Service Application
- VisualSfM
- NLOG
- 3D Model Compliance

A post-disaster information system is presented. This is composed of:
1) a smartphone application for the data acquisition;
2) a web-service for exchanging data with databases, and
3) a local service for managing the 3D reconstruction process

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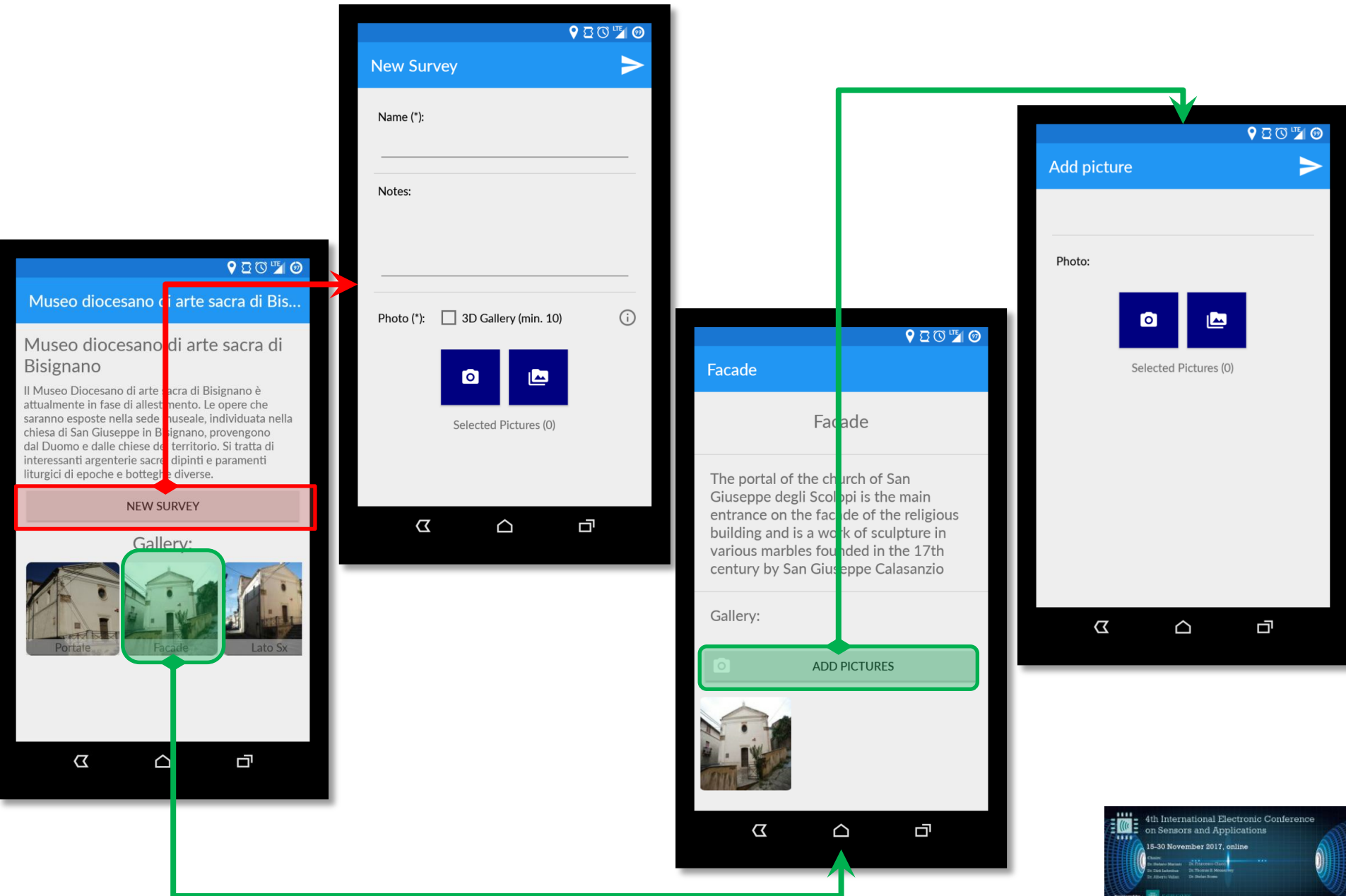3) a local service for managing the 3D reconstruction process
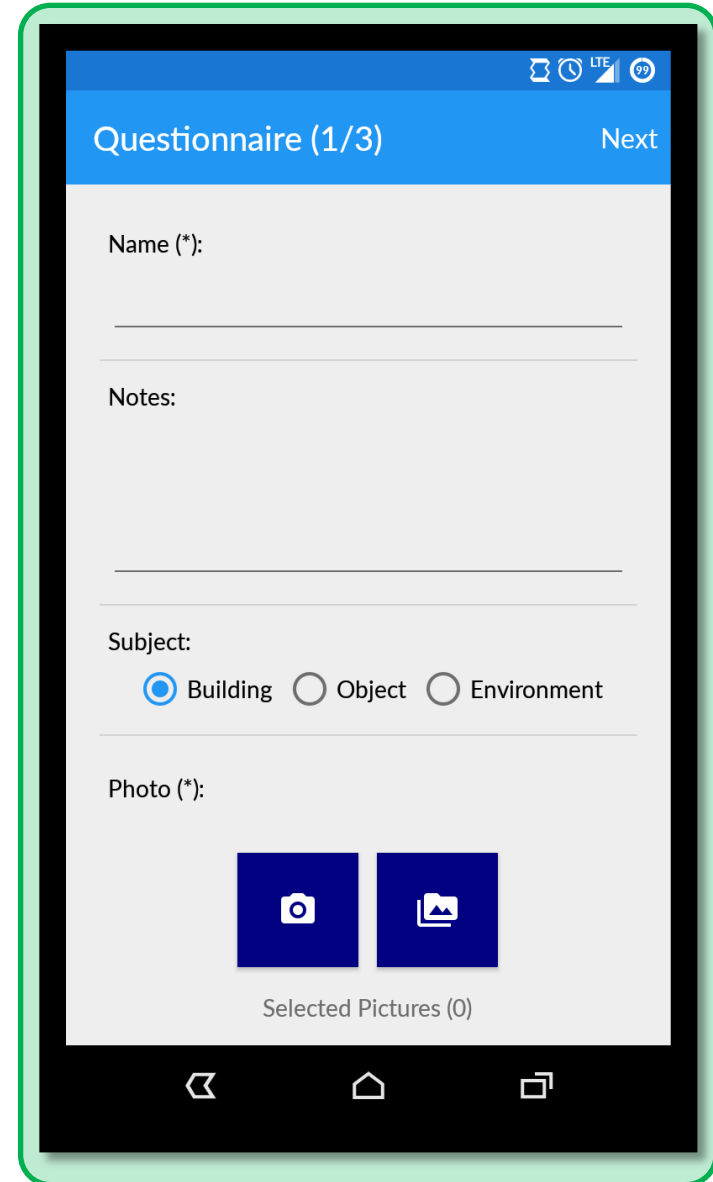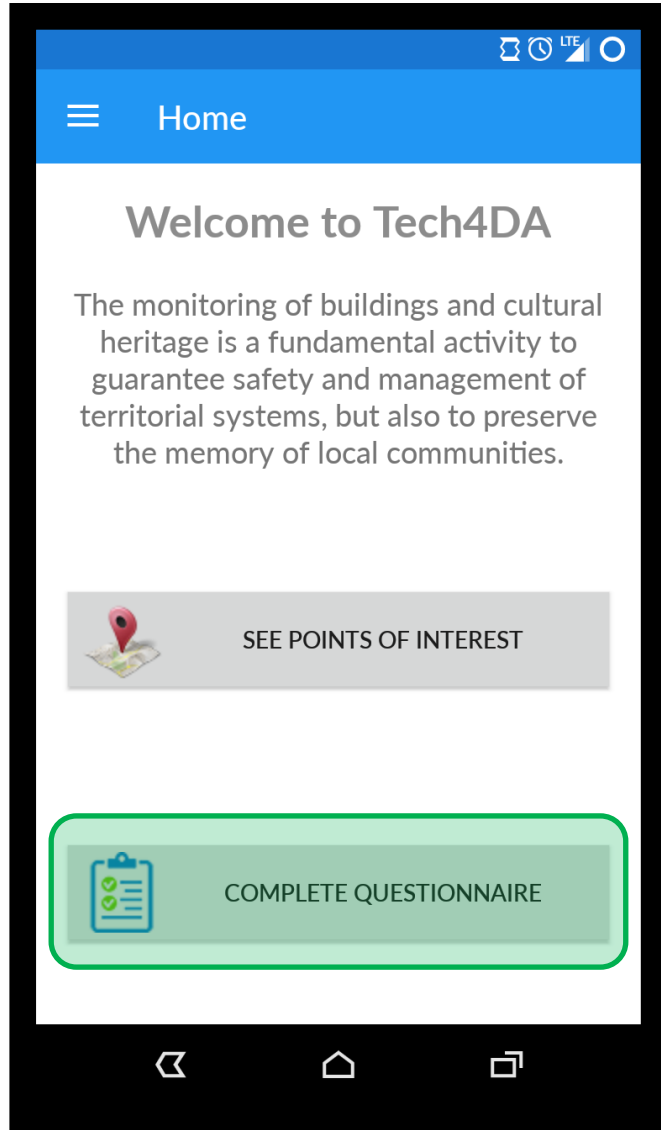
# Mobile App (1)



By touching a pin marker on the map, the name of POI and first 40 characters of its description are shown. Once the users clicks on the information icon…
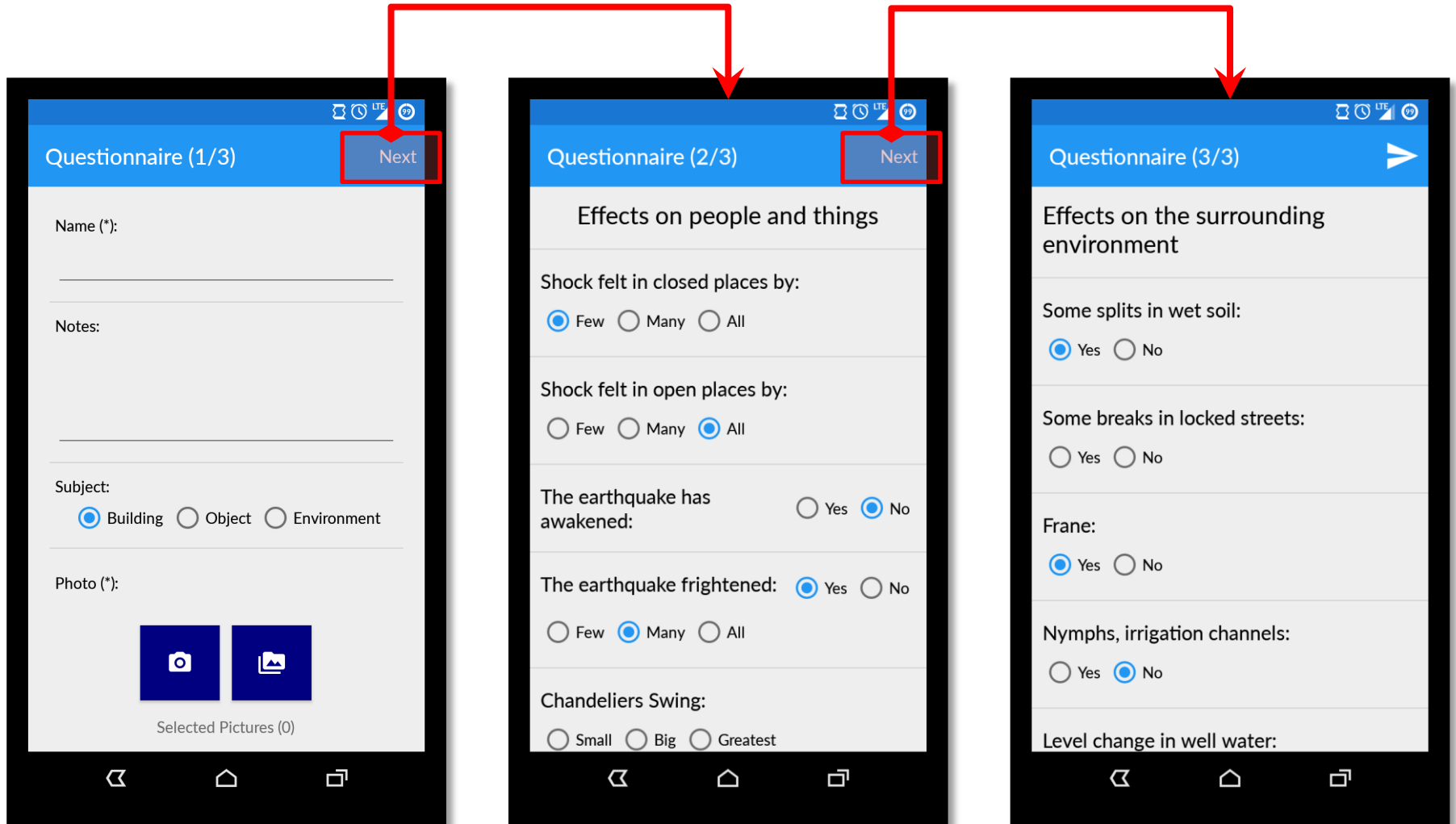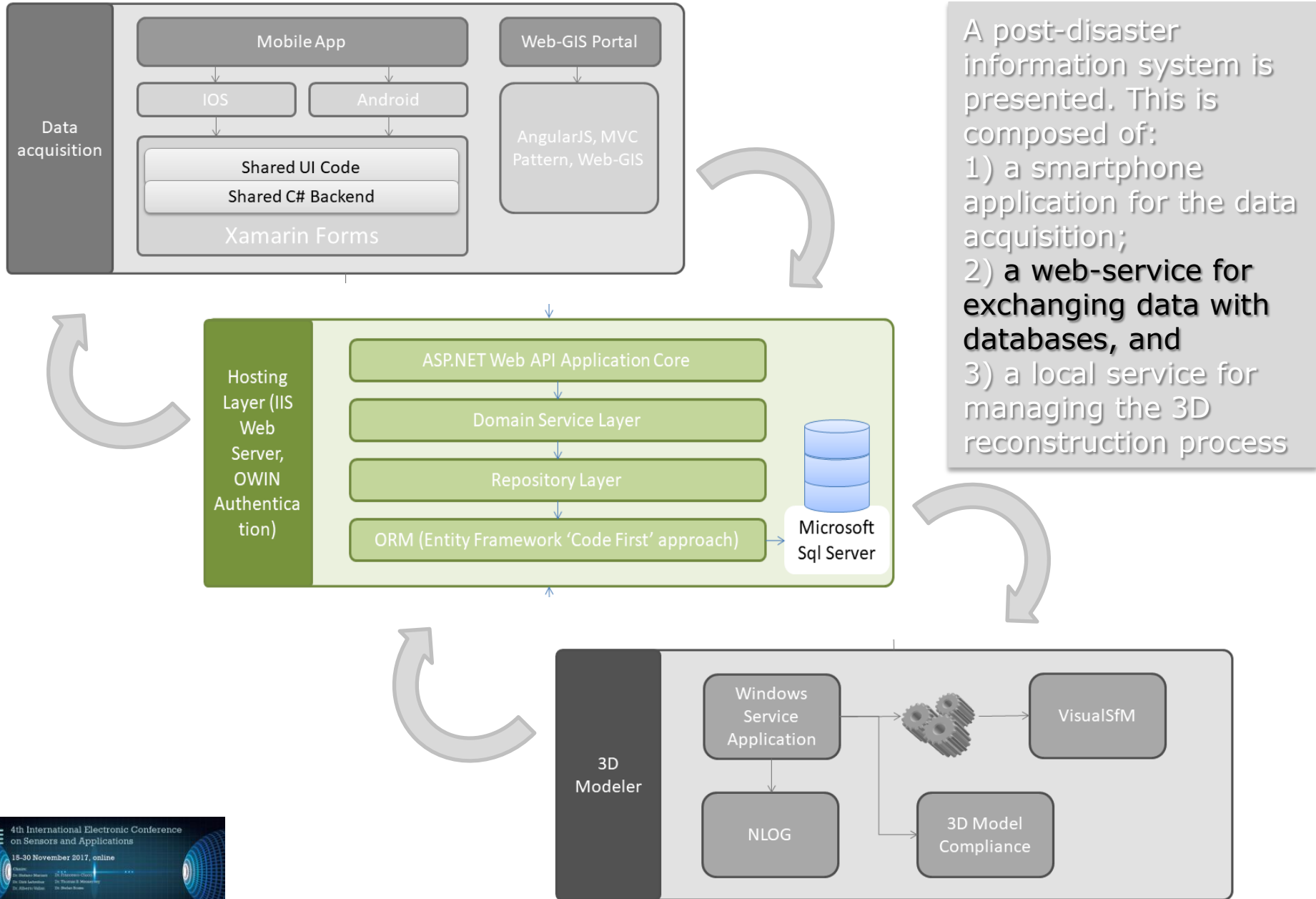
# Mobile App: POI and data acquisition

# Mobile App (1)

# Mobile App: questionnaire



Pages implemented thank suggestions of the INGV QUEST Team

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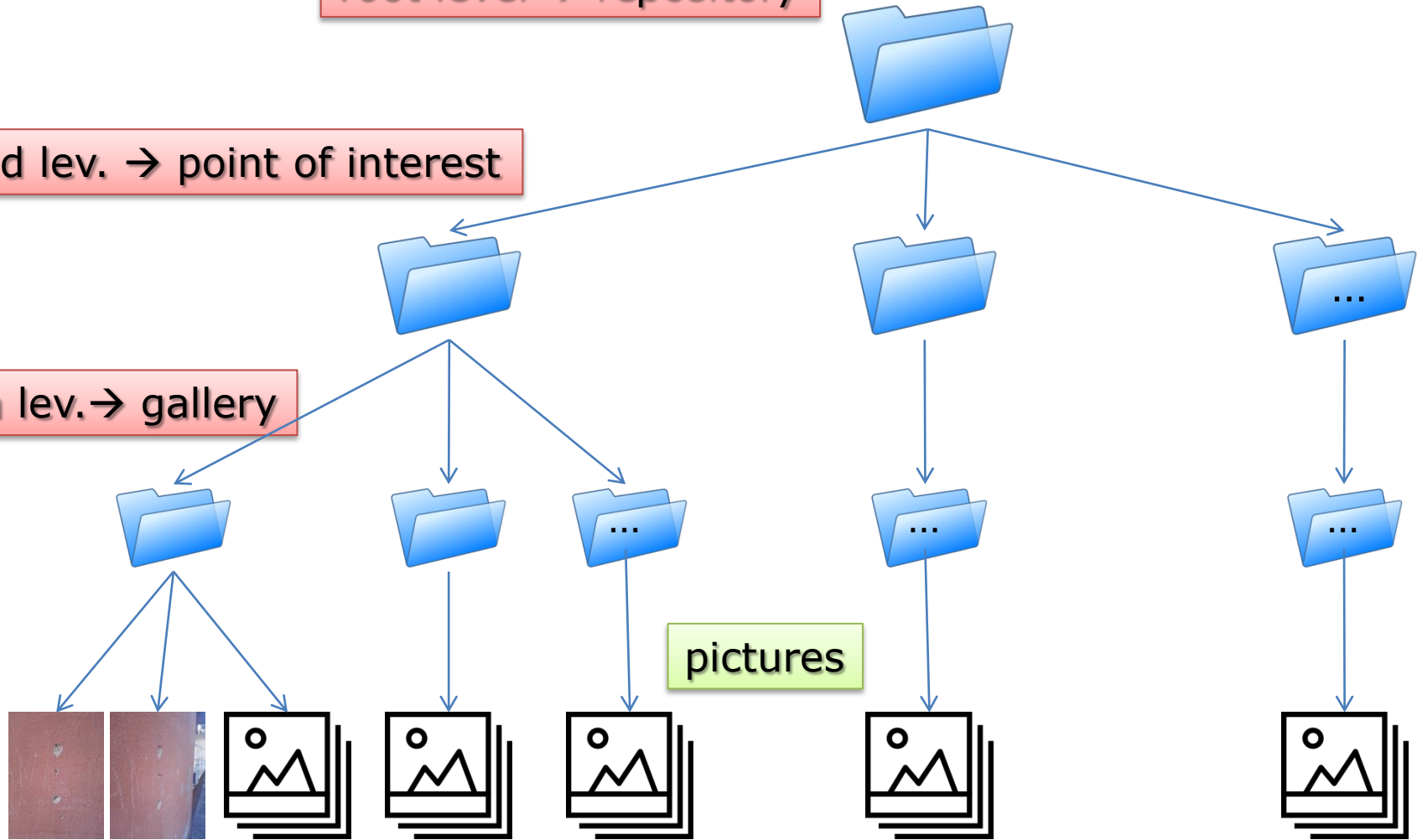3) a local service for managing the 3D reconstruction process

# Hosting layer : file system structure



root level → repository

2nd lev. → point of interest

3th lev.→ gallery

pictures

# Controller classes and Authorization system

## Crontoller classes

All controller classes share the CRUD standard operations.

Particular controller class are implemented:

1. for classes returning a POI list, a method to get objects into a circular area;
2. for classes saving images, a method to save images both in original and thumbnail size;
3. for classes returning the municipality, a method to detect the administrative territory.
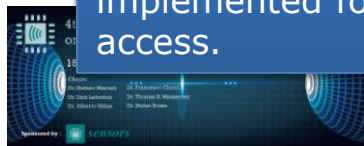
To make the output of the different controller classes uniform, a common object was defined in order to represent data.





*original size*

*150x150px*



*latitude and longitude*

*administrative territory*
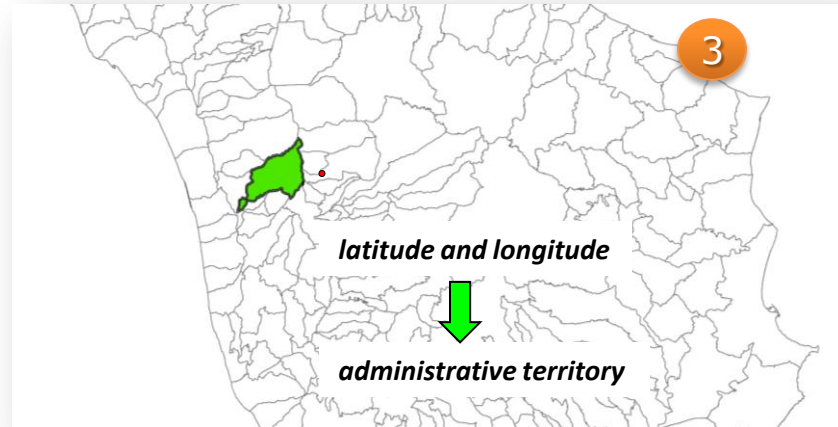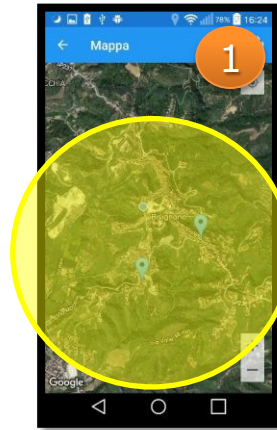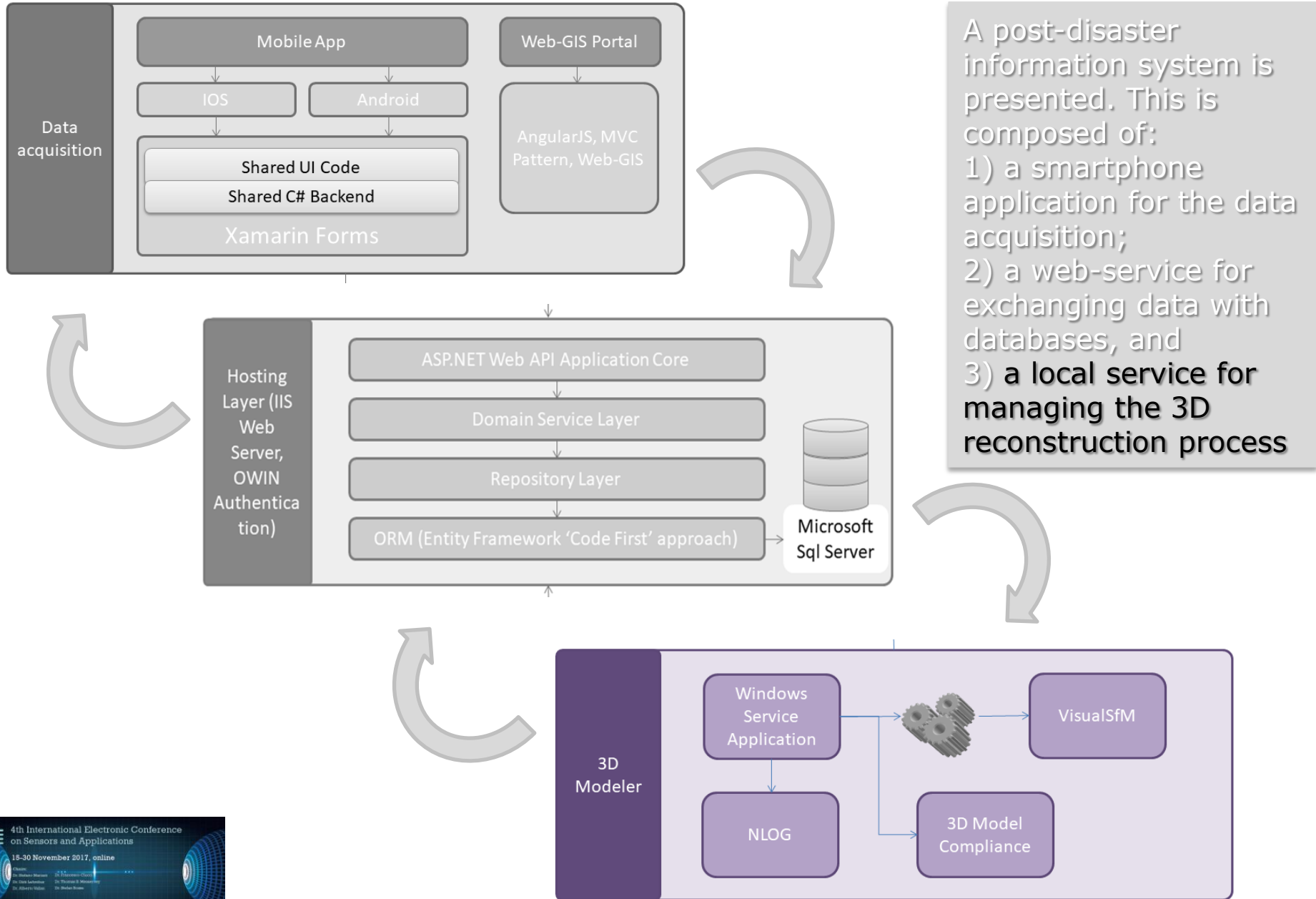
## Authorization system

The "Asp.NET Identity" authentication system, based on "OWIN" framework and "OAuth" protocol, was implemented for managing the data access.

```
{
  "access_token": "BLQY0HrpAqAFsR4sepz6NLDASnP43...",
  "token_type": "bearer",
  "expires_in": 1209599,
  "userName": "test",
  ".issued": "Fri, 16 Jul 2017 09:28:15 GMT",
  ".expires": "Fri, 29 Jul 2017 09:28:15 GMT"
}
```

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# Windows service for 3D reconstruction
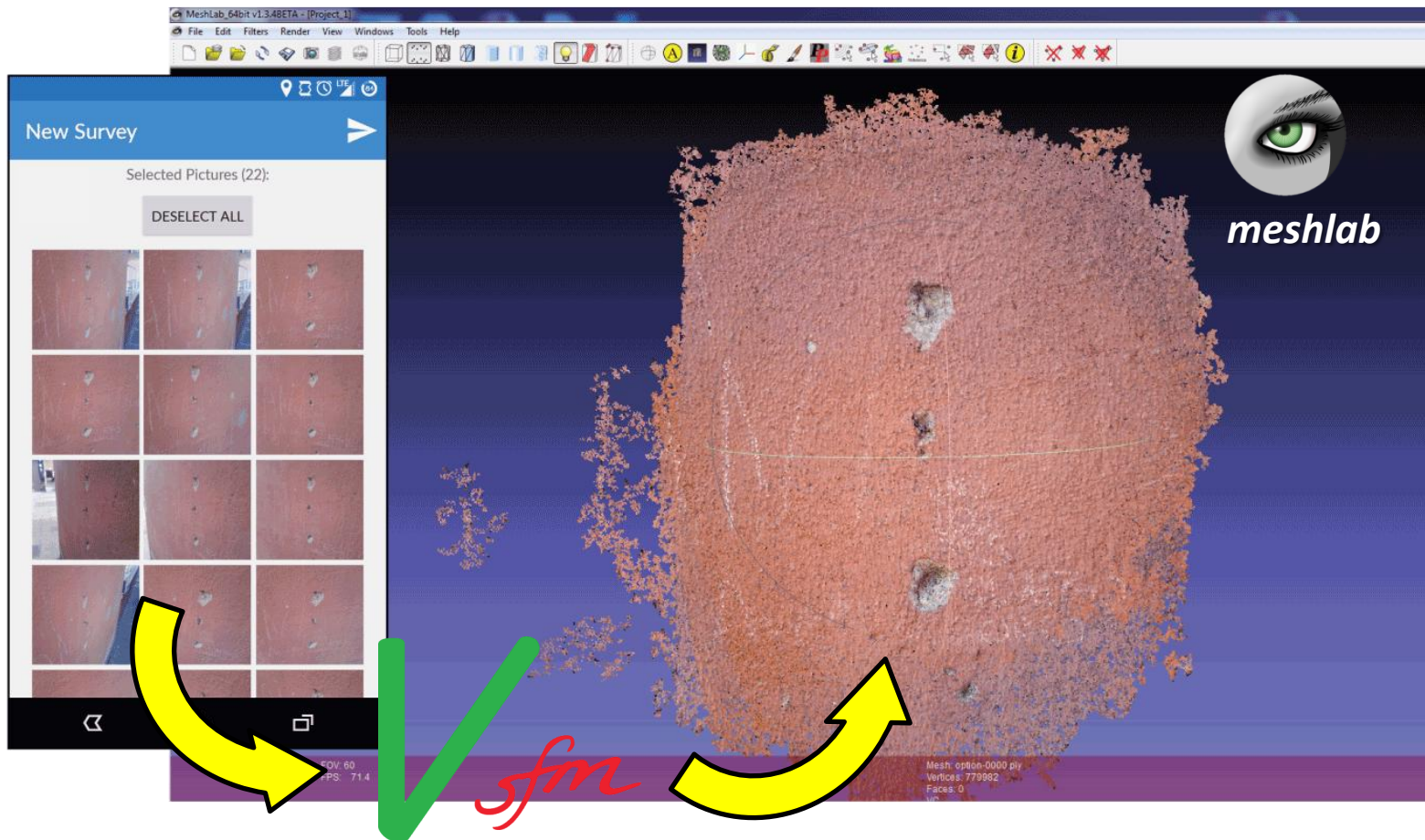


Hourly, the local service check if new galleries are available, in positive case:
- VisualSfM is called and pictures are retrieved;
- once homologous points are detected, 3D modeling is performed;
- at the end of the process, a control is executed on the 3D model;
- a variable is initialized about the elaboration state.

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## Conclusions

An information system for supporting the damage assessment during (and after) disaster-induced emergency phases was designed and implemented.

The main components of such system:

1. mobile application to gather/share data from/with experienced staff and citizens;
2. the web service able to manage exchanges between the devices and database;
3. the Windows Service to control the 3D reconstruction based on collected pictures.

## Future developments

In the stable release some improvements will be introduced:

1. a Web-GIS portal as new client tool;
2. the offline mode for mobile App;
3. an integrated 3D model viewer both for mobile App and Web portal;
4. the reports of damaging related to the buildings and/or cultural heritage.

# Thank you for the attention !

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