Digital Twin
for smart buildings and cities

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Team 7

Bellini Gloria
Cipriano Marco
De Angeli Nicola
De Vera Jessica Serrano
Gargano Jacopo Pio
Gianella Matteo
Goi Gianluca
Ornato Matteo
Pronesti Massimiliano
Rossi Gabriele

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// State of the Art

Business
Real-time analytics
Big data mining and analysis

Visual 3D model
Building classification
GIS system
Volumetric & population densities

Sensors
Environmental monitoring
Waste management
Smart roads

Domotics & Home automation
Domestic management
Occupancy-aware system
Security & infotainment

B.I.M.
Facility & space management

Telecom & Data transfer
Broadband access
Smart car parking

AR & VR
Immersive cultural experience

Emergency
Disaster response and recovery

Spatio-temporal flux monitoring
Traffic control
Crowd management

CO_2

PM_{10}
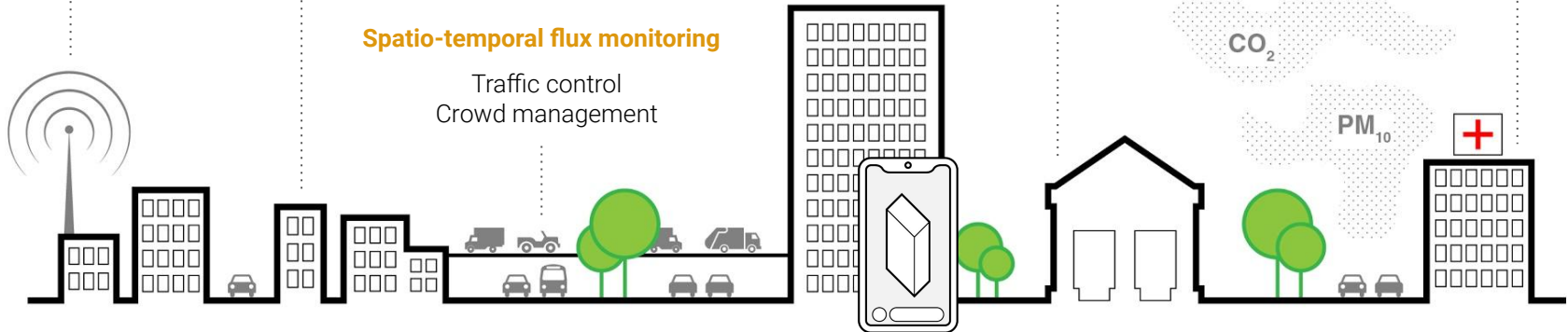
// COVID-related issues
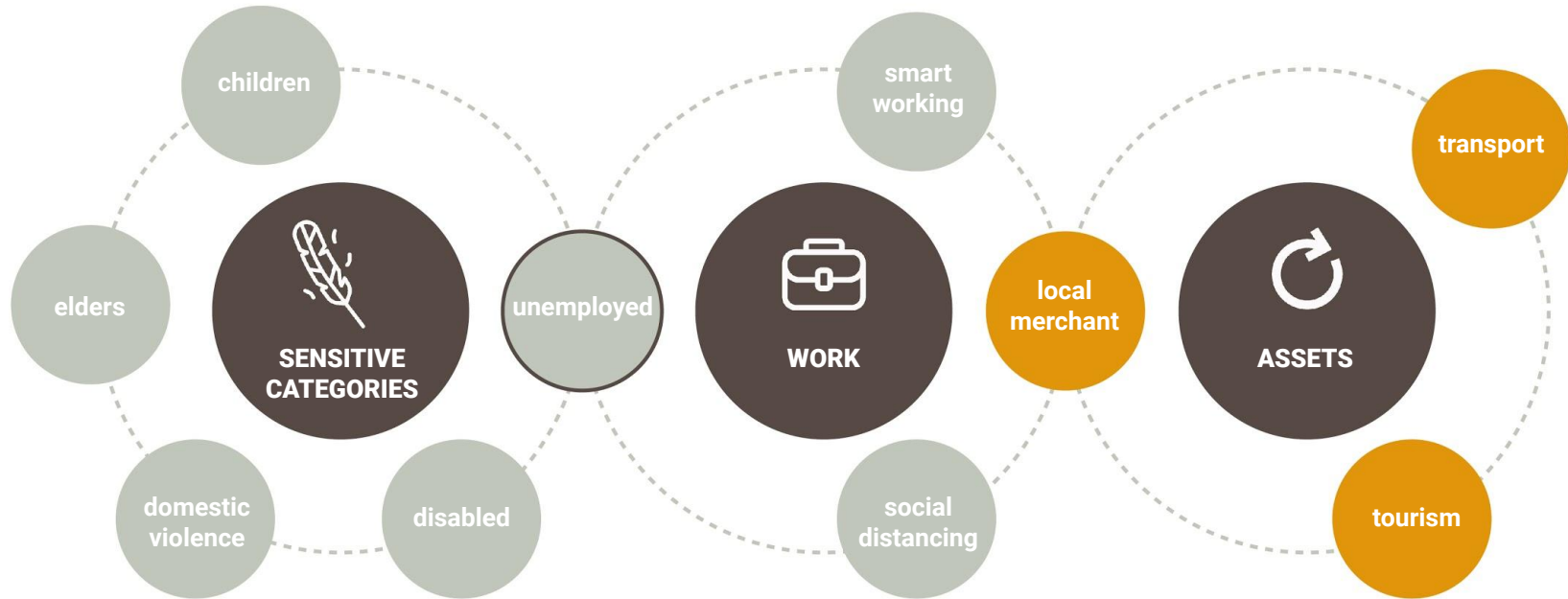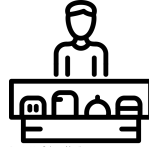
// Customer segments | needs | value

// CITIZEN //

stay safe

maintain usual habits

population density information

crowd monitoring
information
recommendations

// LOCAL MERCHANT //

increase business profit percentage

guarantee customers safety

boost visibility

incentivized customers
through token reward
system

// TOURIST //

stay safe while visiting

smart and safe trip management

online queueing

crowding and queueing
forecast
city insights and statistics

// CITY MANAGER //

enforce health regulations

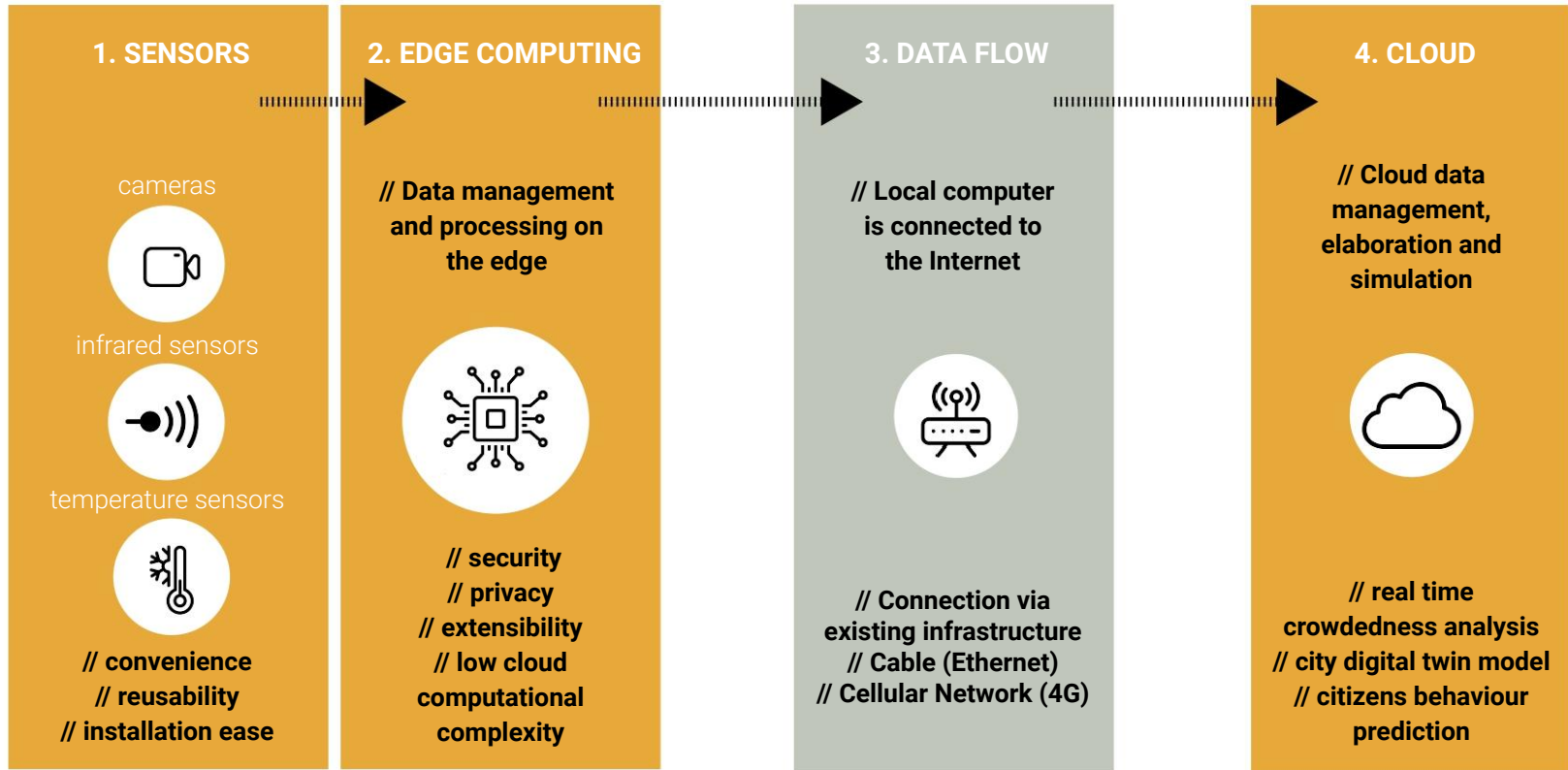**promote local business, tourism and events**

give feedback to public administrators on rules observance

enhanced services and
experience for citizens
and tourists
smart events scheduling

Mobile App

Dashboard

// Physical devices | Data flow

1. SENSORS

cameras

infrared sensors

temperature sensors

// convenience
// reusability
// installation ease

2. EDGE COMPUTING

// Data management and processing on the edge

// security
// privacy
// extensibility
// low cloud computational complexity

3. DATA FLOW

// Local computer is connected to the Internet

// Connection via existing infrastructure
// Cable (Ethernet)
// Cellular Network (4G)

4. CLOUD

// Cloud data management, elaboration and simulation

// real time crowdedness analysis
// city digital twin model
// citizens behaviour prediction

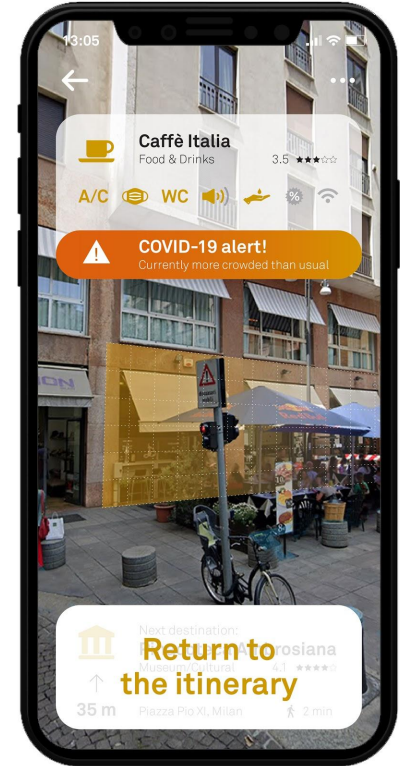*"Become a tourist in your favorite city, take it Zen"*
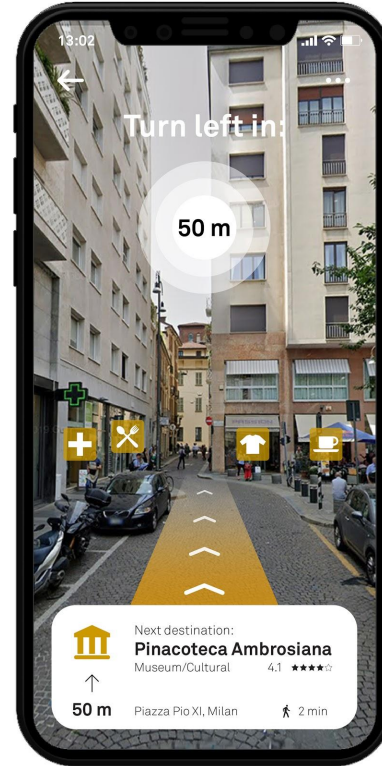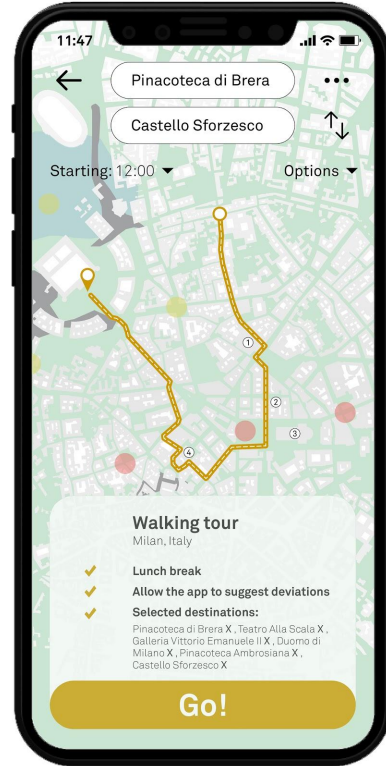
// Mobile app

// Real-time information, recommendations and insights

// Smart Itinerary

// Promotions and Advertising

// Reports and Reviews

// Gamification

// Dashboard for Public Administration

// Real time spatio-temporal crowd monitoring

// Social distancing analysis

// Quality of Life monitoring

// Crowdedness prediction and underused areas identification

// Key metrics

// Number of Users reached

Measured in terms of overall downloads and variation rate, it offers an indicator of how popular our solution is.

// Number of Shops in the Network

This metric provides information on how appreciated our solution is from the merchants point of view.
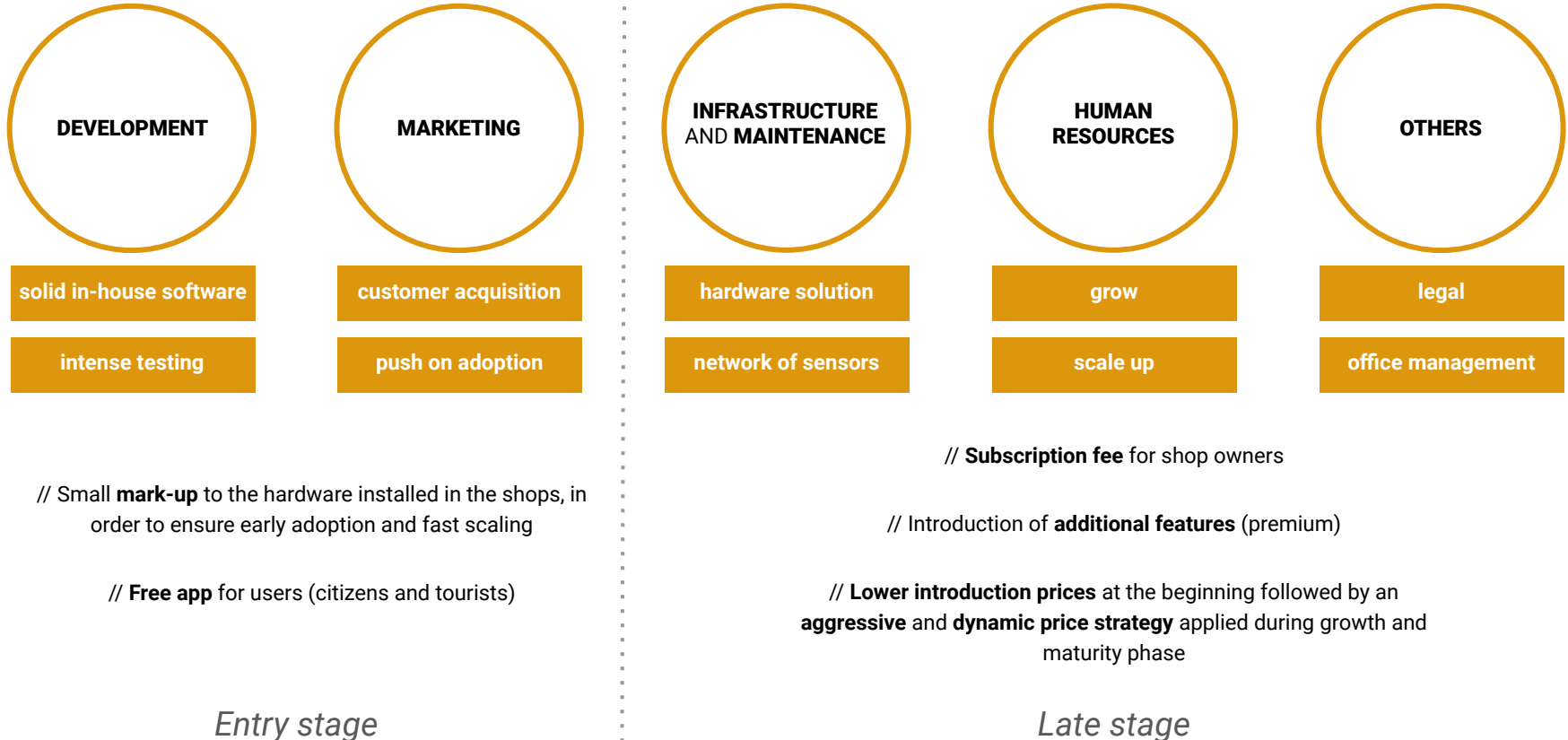
// Number of Interactions

This measures how active and involved is the community sustaining the platform.

// Cost structure | Revenue streams

DEVELOPMENT

solid in-house software

intense testing

MARKETING

customer acquisition

push on adoption

INFRASTRUCTURE AND **MAINTENANCE**

hardware solution

network of sensors

HUMAN RESOURCES

grow

scale up

OTHERS

legal

office management

// Small **mark-up** to the hardware installed in the shops, in order to ensure early adoption and fast scaling

// **Free app** for users (citizens and tourists)

// **Subscription fee** for shop owners

// Introduction of **additional features** (premium)

// **Lower introduction prices** at the beginning followed by an **aggressive** and **dynamic price strategy** applied during growth and maturity phase

Entry stage

Late stage

// Interconnection | Health

"A patient-specific map of the city showing the health of its places in relation to the specific user's clinical conditions and preferences"
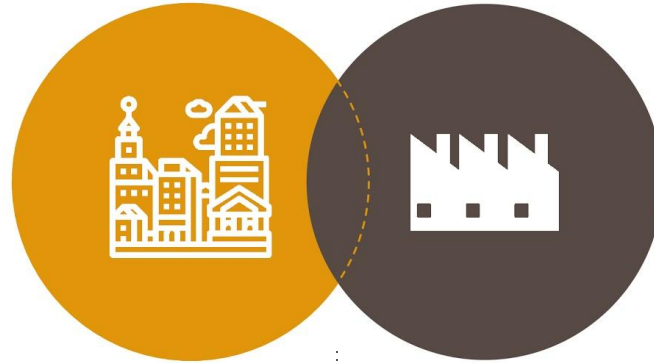

Sensors and Data Integration

// Cameras for social distancing to avoid crowding, especially for sensitive categories (From **TouriZen**)
// Cameras' footage audio for noise pollution (From **TouriZen**)
// Temperature and humidity of shops for air quality (From **TouriZen**)
// Further sensors from other sources (e.g. **ARPA** and/or **WiseAir** data about air quality)

"A Building Information Model of the factory in order to rearrange the workplace according to the safety measures"

Sensors and Data Integration

// Cameras to detect workers position through image-analysis
// Temperature and humidity sensors to monitor air quality
// BIM, a model of the facility

# // Lessons learnt | Critical problems

Importance of system **extensibility** and **scalability** to add more features and sensors easily and economically

Value of **reusing already existing assets** and possibly newly installed ones in the future

Users **privacy** and **data management** is fundamental

Digital Twin as a representation and support for humans **not as a substitution of human knowledge**
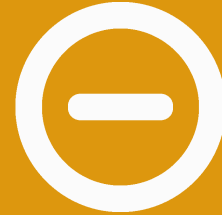
The system **might be used non-ethically** not for good

Crowdsourcing and human-as-a sensor requires **solid users collaboration**

Merchants could reject the solution if perceived as a limitation for their business

Need of reaching a significantly high critical mass

Not considering also "non-measurable/measured data" might lead to **relevant approximations** and **unwanted gaps** between DT and reality

Thank you

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