

ECOSYSTEM INNOVATION BY TUNGSRAM

Introduction

Innovation is our heritage

Established as United
Electric Ltd.

1896



1909

Tungram brand
registered

Lipót Aschner founded
the world-famous
research lab and makes
the brand a world market
factor

1921



1931

Imre Bródy, a
researcher at
Tungram develops
Krypton lamps

Zoltán Bay, the technology
officer of the company
founds radar astronomy
by a world famous
experiment

1946



1989

GE purchases the
majority of Tungram
shares, later 100%

Tungram Group is
founded

2018



Tungsrám has a 120-year long track record and unique assets and capabilities

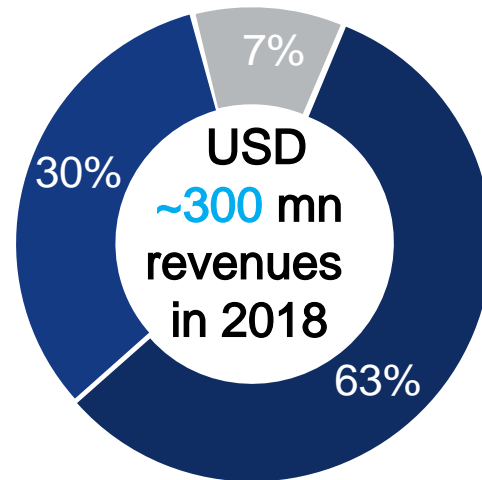
Over 120 years
of reliable operations

1896

World-class innovation
heritage



● General lighting ● Automotive lighting ● Components



4000+ employees in
Hungary and globally



Established sales network in
a **100+** countries:
95+% export

Tungsrám Edge
new innovative business



Agritech
indoor farming



**Smart City
Solutions**



**PropTech
Solutions**



**Open Innovation
Center (InnoHUB)**



5 plants for
advanced lighting
technologies and
components



20+ Tungsrám
subsidiaries globally.
Offers global access for
Hungarian SMEs



Ceramics, metal,
glass, plastic quality
and tooling
capabilities



Expanding Hungarian
technology center,
SMART everything.
Close network with
Hungarian and global
researchers



Advanced materials in
new industries like
Aviation, Automation,
Batteries, Healthcare &
Power



Unique Company -in-the-
boks offering for investors
entering the EU with minimal
up-front investment enabled
by shared Tungsrám
infrastructure and resources



Business Vision— Innovation Mission

- We add new products/services beyond TU heritage markets.
- We do it speed-to-market: connect to/grow on current TU competencies and deploy latest innovation practices.
- We build an international ecosystem and multiply our impact by leveraging on external funds.

Priorities 2019

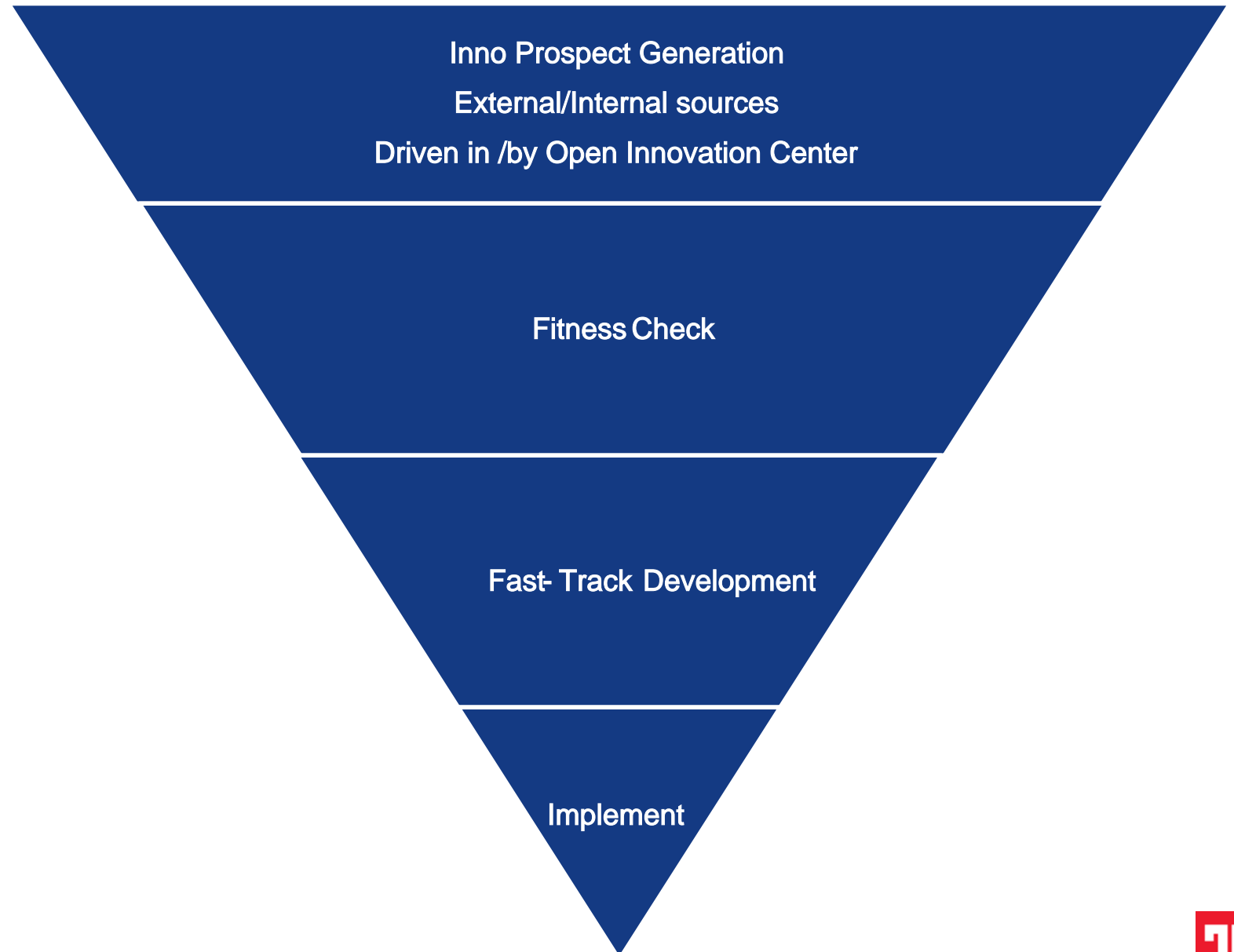
Design and launch innovation engine

- ▶ structure and processes
- ▶ competencies and staffing
- ▶ complete and learn from pilots

Continue build AgriTech and PropTech lines

- ▶ marketable products/services

The Innovation Funnel



Tungsram – Startup Campus cooperation



- Startup Campus (SC) aims at providing a safe and supporting atmosphere for those talents having innovative startup or company ideas in order to kick start their careers.
- As part of our cooperation, SC plans on launching four new programs to develop the Hungarian innovation ecosystem, discover new talents and display Tungsram as a key supporter of innovation.
- SC and Tungsram together seeking for opportunities of extending the program for building V. renovation and development (possibly funded by HEPA)

TU Open Innovation Center

Opportunities

Content by Startup Campus

- Entrepreneurship education
 - Acceleration program (Debrecen) until end of 2020
- Market expansion
 - Scouting for foreign scaleups in Berlin and London
- Constant visibility in innovation communities

Services byTungsrām

- Technology development
- Preparing manufacturing
- Manufacturing
- Market validation
- Consulting: (IP, company valuation)

Implementation

Content by Startup Campus

- Service agreement for 14 months
- Option to extend by further years

Services byTungsrām

- Sales contact for contracting offered services
- Contact points for service delivery and laboratory access

Tungsram Open Innovation Platform powered by iLex



TUNGSRAM'S VISION

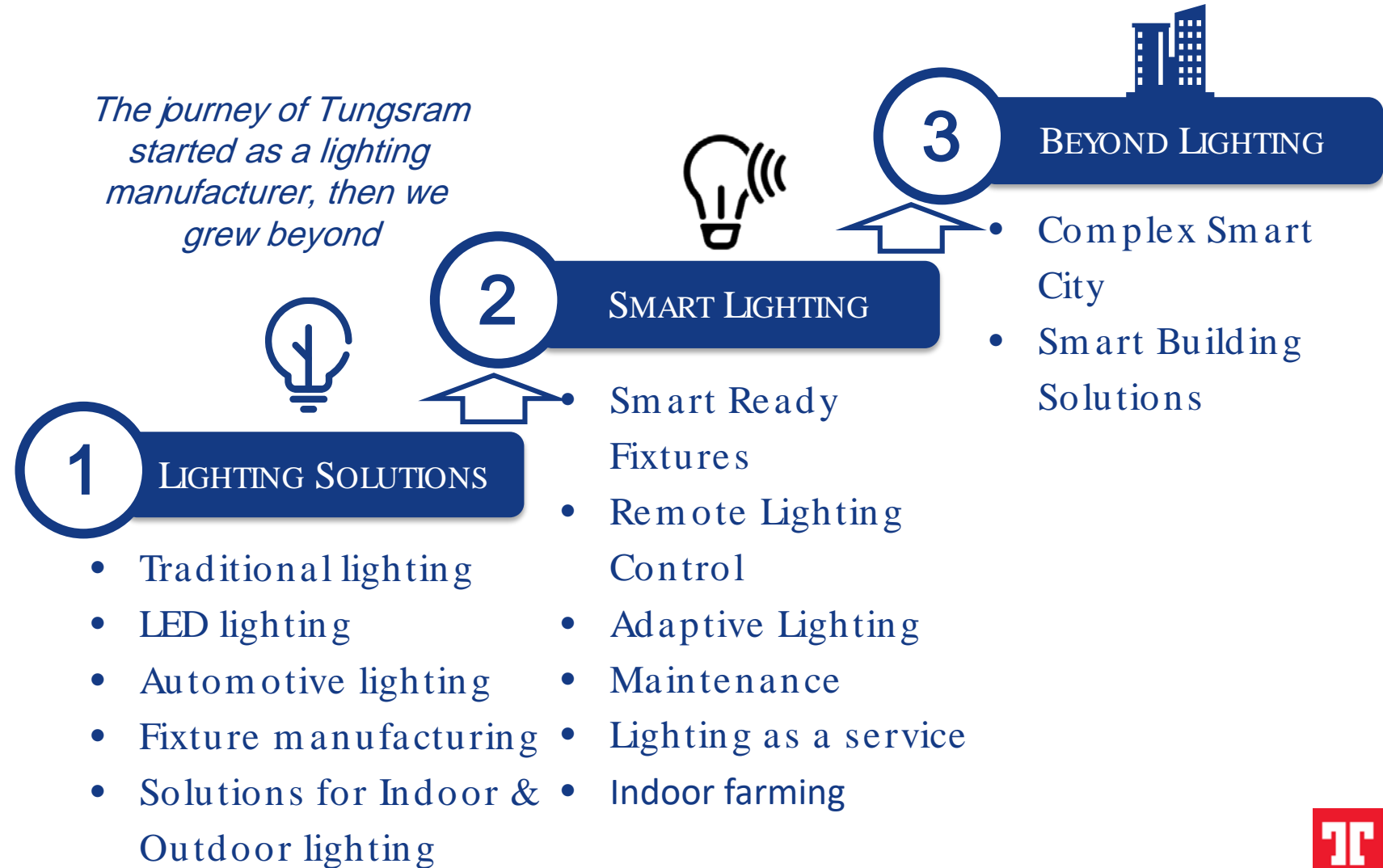
Tungsrām delivers innovative physical and digital solutions for inhabitants and enterprises of a city to strengthen environmental, social and economic sustainability

TUNGSRAM IS A TECHNOLOGY SOLUTION INTEGRATOR

BASED ON ITS OWN CORE COMPETENCIES

~~We deliver end-to-end solutions with a widespread partner ecosystem~~

The journey of Tungsrām started as a lighting manufacturer, then we grew beyond



STREETLIGHT CONTROL CENTRAL MANAGEMENT SYSTEM SOFTWARE

There are multiple benefits to use Tungsram smart lighting technology



1

Advanced remote monitoring tools

- **Detailed parameters** like energy consumption monitoring (Wh, VARh, PF, Frequency etc.) available for unique fixtures and complete lighting infrastructure

2

Smart city communication backbone

- **Unlimited number** of fixtures can be **connected** to the **central management system** and displayed on a map view
- System recognizes when a fixture is not functioning and creates an alert

3

High security

- Fixtures can **communicate wireless** in a **secure** way

Higher service level due

SMART OUTDOOR APPROACH

Problem need to be solved:

In case of Smart City future applications lot of sensors will provide lots of data for years in most of the cases without power

Solution:

Cellular, wireless connection technology optimized for very low power consumption - battery life can last about 10 years - with dashboard for big data management and analytics

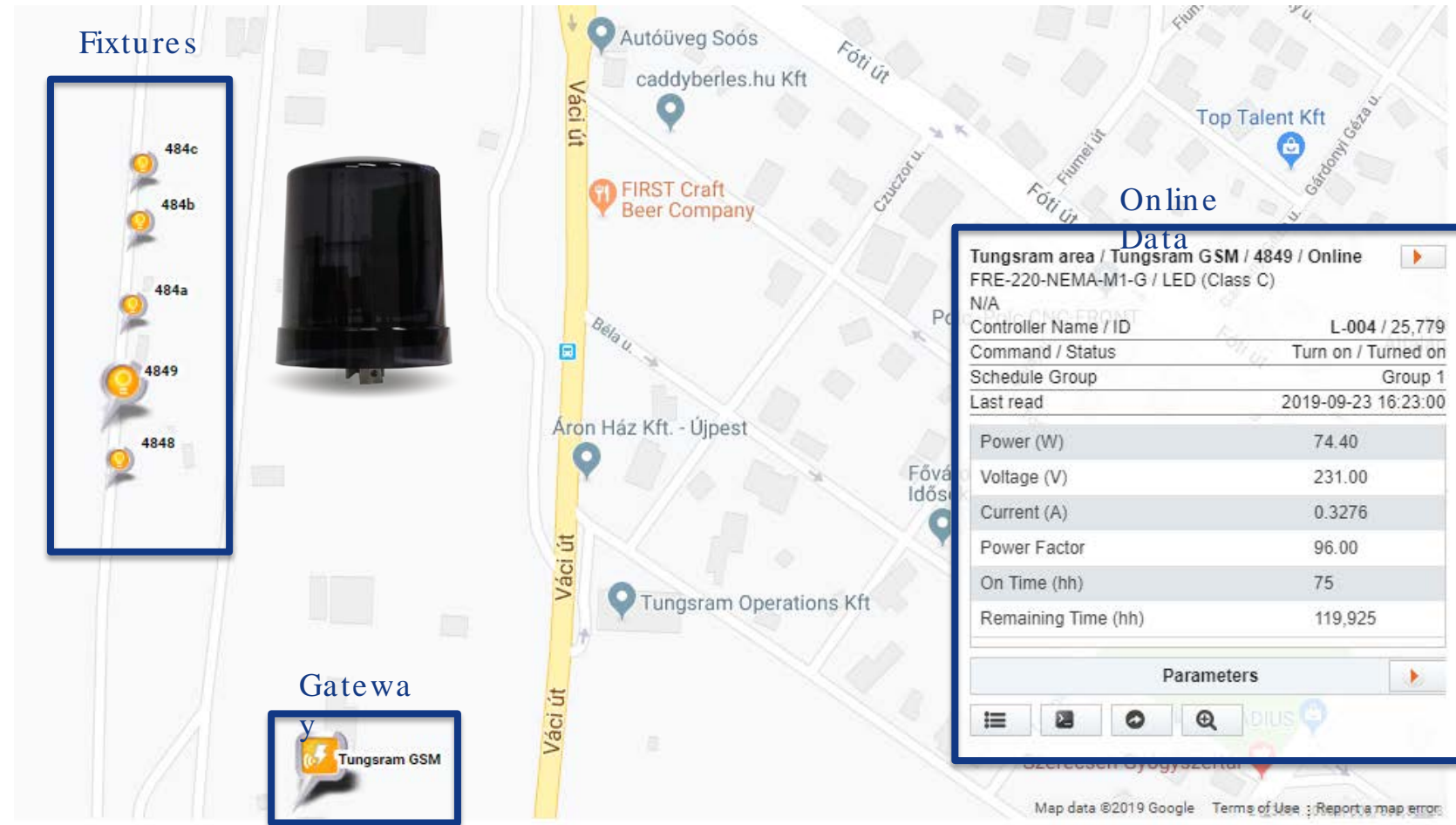
Challenge:

Several cellular technologies are existing - need a gateway – most promising one NBloT is under testing.

2

PROPOSED FEATURES

- Intelligent device connected to streetlamp with monitoring system (CMS)



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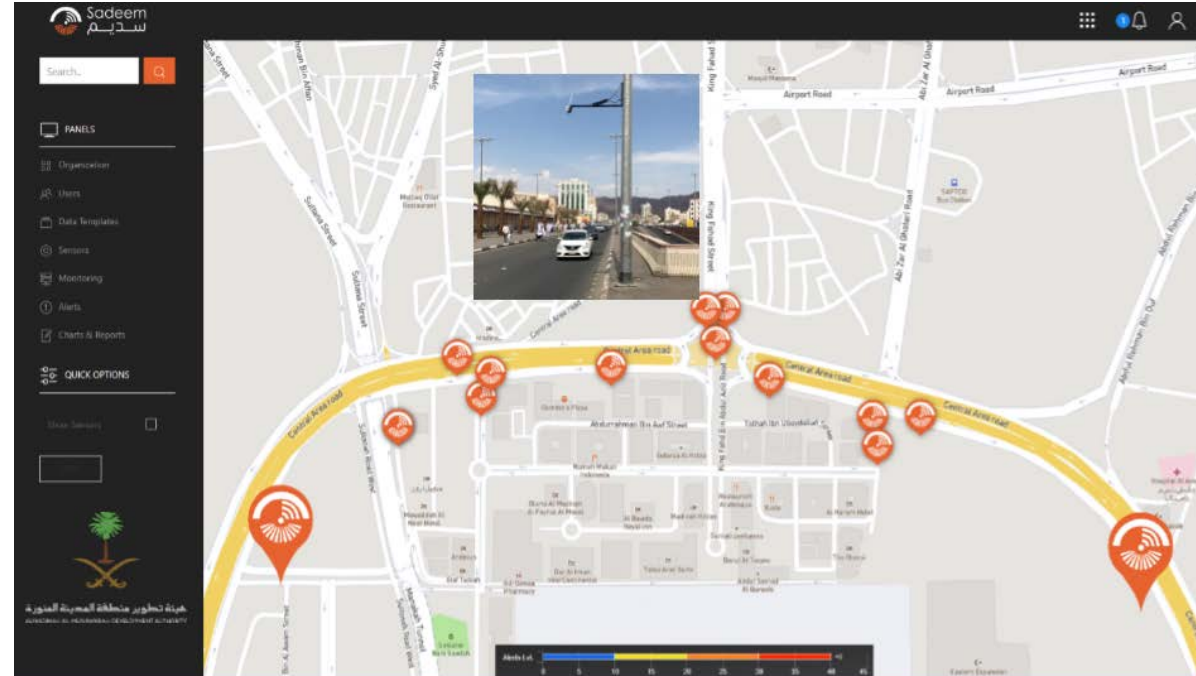
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PROPOSED FEATURES

- Traffic mapping with machine learning algorithms and radar technology



Case Study: Al-Madinah Development Authority (MDA) Sadeem implementation (Phase I) October – December 2018

Plug and Play solution § Independent from Power Grid § Traffic density
§ Vehicle classification § Vehicle counts per multiple-lanes § Speed estimates

Example of our Saudi startup company partnership



Smart City & Prop Tech

TUNGSRAM SMART SOLUTION GOALS

WE FOCUS ON ACHIEVING THREE PRIMARY GOALS WITH OUR
SOLUTIONS

1

Cost Saving

2

Energy
Efficiency

3

Comfort &
Well-Being



TUNGSRAM SMART CITY

BENEFITS OF OUR SOLUTION:

- ATTRACTIVENESS
- ENERGY EFFICIENCY
- WELL-BEING
- ECONOMIC COMPETITIVENESS

Lighting Modernization

Smart Outdoor Lighting

Facility & Asset Management

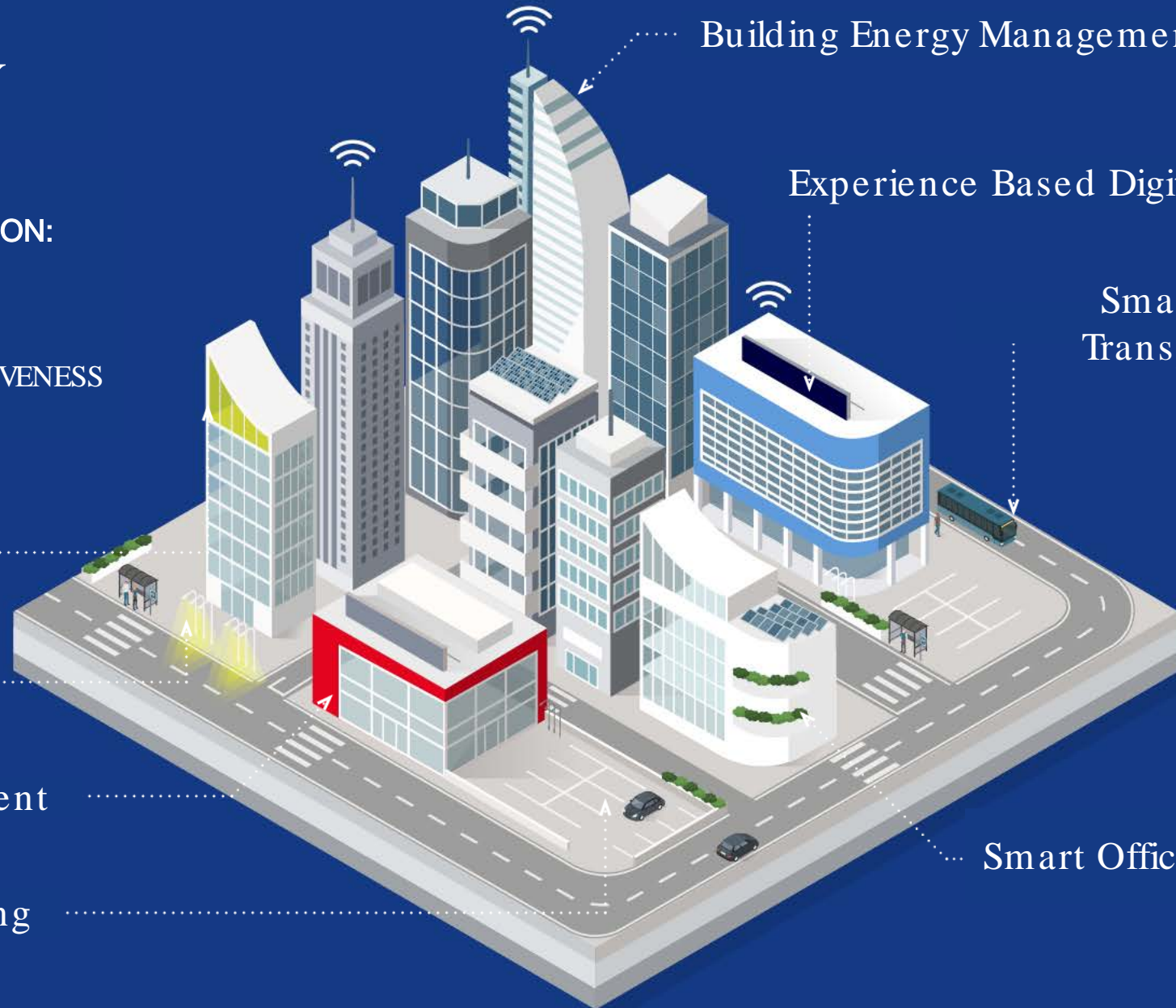
Smart Traffic & Parking

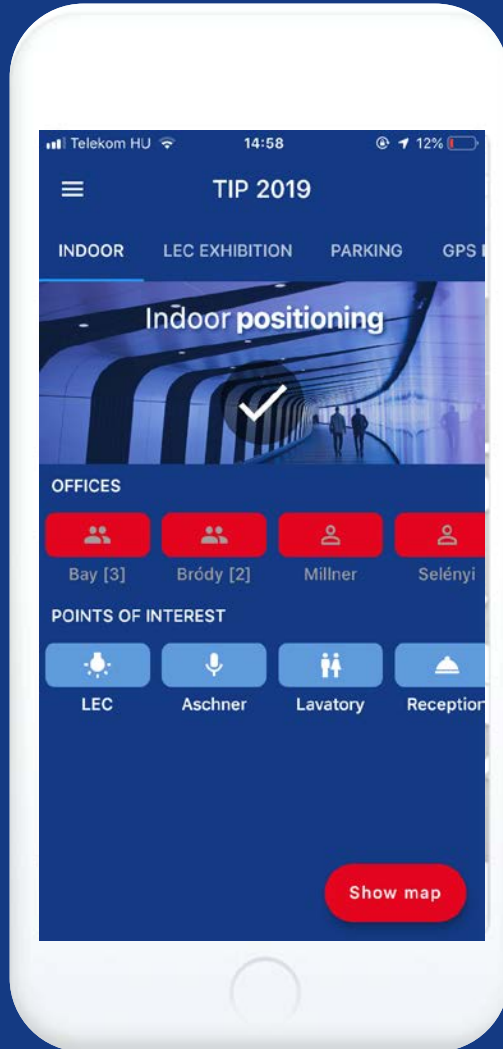
Building Energy Management

Experience Based Digital Education

Smart Public
Transportation

Smart Office





①

Smart Parking

Finding the **optimal parking slot**, ensuring the least amount of time spent walking around in parking lots

Monitoring **real-time** parking lot **utilization**

Optimization of parking **areas** based on actual usage data

Allowing **online parking reservation** and automatic **payment**

②

Indoor Navigation

Locate and navigate to various POIs, meeting rooms, storage rooms, lavatories, exhibitions

Provide **location based information**, **heat maps** – eg: most frequented visited areas

Tracking the preferred **routes** of personnel and visitors

③

People counting

Creating **real-time** and **historical** data for **occupancy** in office areas, corridors, retail units, building entrances etc.

④

Ambient Sensors

Adapting air conditioning, lighting and ventilation to different environmental indicators and building utilization levels

Creating an **adjustable, comfortable environment** for the visitors based on the actual environmental details

BUILDING MANAGEMENT WITH TUNGSRAM

We offer property, facility,
workforce & asset management
and building information
modeling solutions



1

Maintenance

Tungsrām's facility management software provides a **single platform solution** for **every maintenance activity** occurring in side and around the building.

We create a centralized platform for **asset management** to keep track of the **status and utilization** of all **assets**.



2

3 Dimensional Building Mapping

Creating the **digital copy** of the building, visualizing every infrastructure element the building contains. It enables **overviewing maintenance** activities in the **digital space**.



Save on building operation and building maintenance up to 20%*

Lifecycle Cost

Design Phase

1%



Construction Phase

9%



Operation & Maintenance Phase

90%





Audi

VW group has the largest engine factory of the world at Gyor, Hungary

The factory was opened at 1993 and they produced almost 2 million engines since inception

Our ArchiFM solution is managing 150.000 work orders related to facilities on a yearly basis



COST SAVING RESULTS



Savings in FM costs per year with ArchiFM: 1,6 M EUR (20%)

Major cost reduction points:

- Clarification of owner rights
- Rationalization of operating expenses
- Decisions supported by up-to-date information





Puskas stadion is named after the legendary hungarian football player Ferenc Puskas

The stadium will be opened mid November 2019 and will have an astonishing seating capacity of 67 thousand

Puskas Konzorcium selected ArchiFM as their BIM based property management solution



Agritech

CONTROLLED ENVIRONMENT SPECIALITY FARMS

Macroeconomical drivers

Growing need for healthier food:

- Locally grown
- Near urban areas
- In a more efficient way
- All year-round

Main reasons:

- Growing population
- Scarce natural resources
- Changing customer demands
- Controlled plant cultivation environment
- Local production
- No use of pesticides

Comparison of Open Field Growing Technology and Indoor Farming Capabilities

Vertical farms:

- Closed, controlled environment
- Year-round production
- Less land, water and fertilizer
- No pesticides



Production example:
Lettuce



6 300
heads/m²/year

Greenhouse:

- Partly exposed to environment
- Recycles 50-70% of water



420
heads/m²/year

Open field:

- Impacted by weather, pests and invasive species
- Need of large amounts of land, water, pesticides and fertilizers
- Seasonal crop production



20
heads/m²/year

TUNGSRAM PRECISION INDOOR FARMING

SCIENCEBASED AGRICULTURE

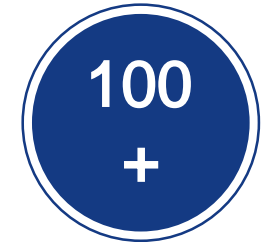
Precision indoor farming is science-based agriculture where we are **partnering with the most prestigious academic organizations** from Netherland , UK, Germany and other European Institutes



years of
operation



subsidiarie
s
globally



countrie
s export



productio
n export



employees



production
plants

In the last three years together with our R&D partners we conducted 50+ experiments with differenet plants in vertical farm environment in.



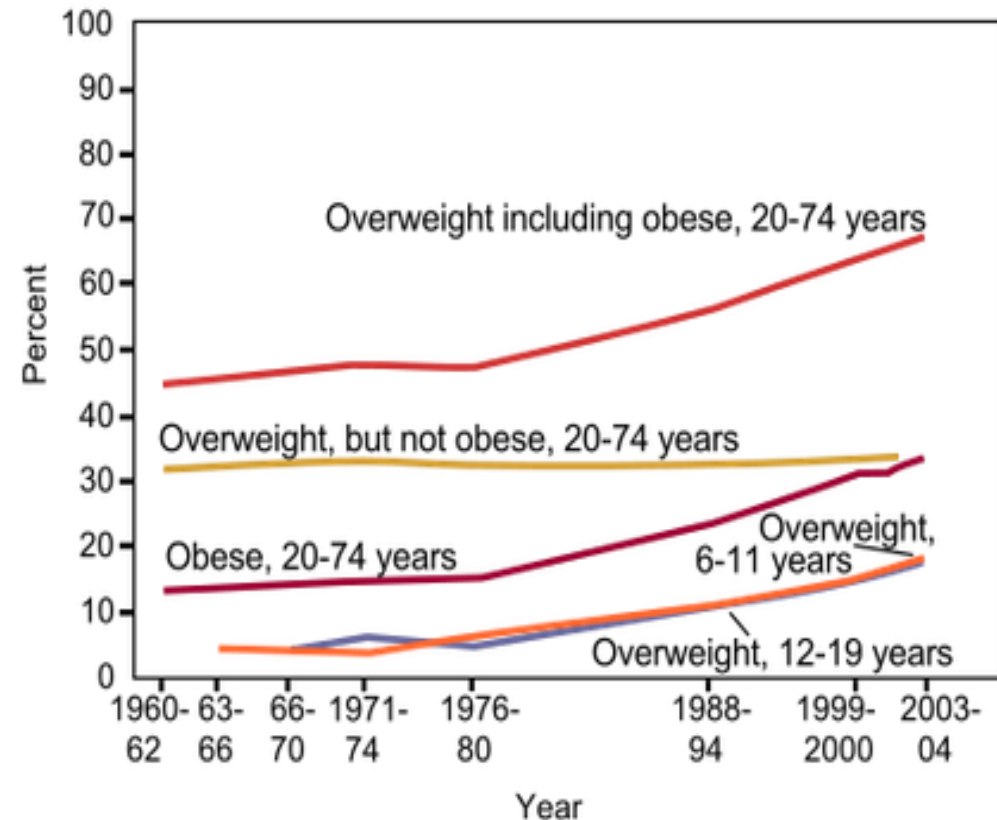
Infratrainer

MARKET ENVIRONMENT

DYNAMIC INCREASING MARKET

- According to WHO data, by 2030, 58% of the adult population will be overweight
- The same is confirmed for US by NCHS saying that close to 70% of 20-74 years old US population, approx. 180 million people, suffers from overweight or obesity.
- Overweight is not only an aesthetic problem, but poses a serious health risk

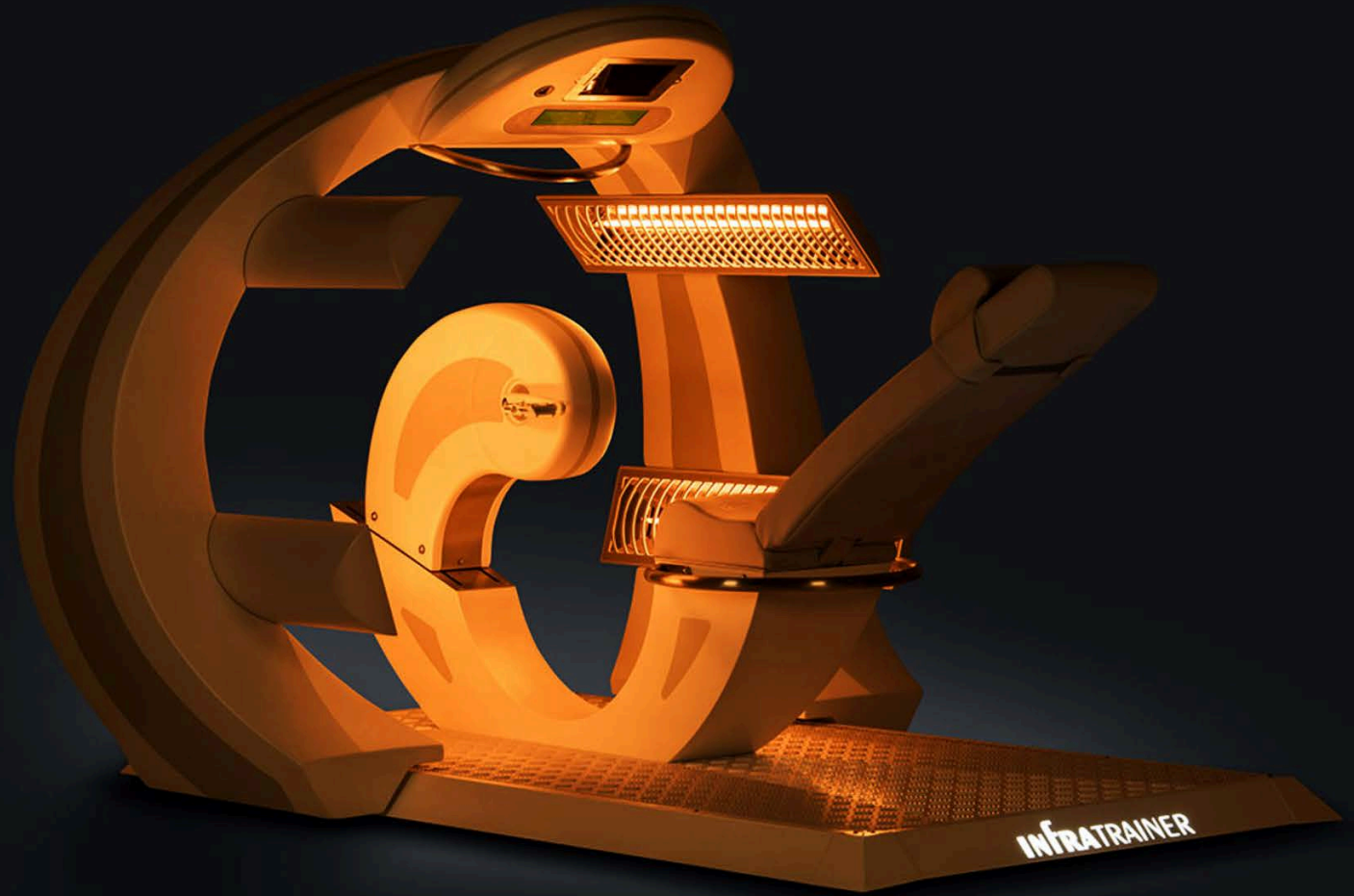
Overweight and obesity



SOURCES: Centers for Disease Control and Prevention, National Center for Health Statistics, Health, United States, 2006, Figure 13. Data from National Health and Nutrition Examination Survey

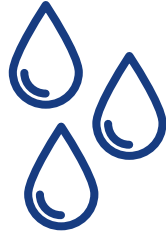
INFRATRAINER TESTIMONY

- 3 years of operation and 130-150 machines in 100 studios across Hungary
- Typically high, 80%+ utilization of the equipment; 1,000+ guests per day across Hungary
- It has already received CE and TÜV certifications
- Entered to the neighboring European countries, such as Austria, Germany, Slovenia, Slovakia, Romania; Russia and Poland are soon to come
- UK and Canada are just about to start



FURTHER EFFECTS OF USING INFRATRAINER

Infratrainer fundamentally changes the concept of weight loss, body shaping and detoxication .



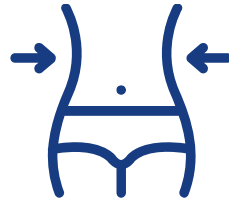
DETOXICATION

Sweating is a safe and the most natural way of detoxicating the body. Training with the Infratrainer generates the highest possible rate of sweating besides a low intensity muscle work.



HEALTH OF CELLS

Infrared light therapy improves the oxygen supply of the cells, intensifies their metabolism, helps the regeneration of muscles and strengthens the immune system.



COLLAGEN PRODUCTION

Collagen plays an important role in creating the space between cells, the flexibility of bones and in the structure of cartilaginous tissue. The Infratrainer stimulates the production of collagen that gives shape to the body, it smoothes wrinkles and rejuvenates skin.



ANTI-AGING

With the effect of infra light released by the Philips Vitae™ infrared lamps and doing the training in the personalized fat - burning zone, massive amounts of toxins leaves the body that rejuvenates and smoothes out the skin.

