Interreg CENTRAL EUROPE
European Union
European Regional Development Fund

FabLabNet

PILOT ACTION EVALUATION

DT252 - PP8 - Partner Report on Pilot 3
System Thinking in IT and Digital Fabrication

Version 1
06 2018

Tables of contents

Short overview of the Pilot Action 3
- Course contents: 3
- General information: 4
- Student projects: 5
  - 01.Smart sensors for Intelligent House; Rastislav Krchňavý, Michal Kren 5
  - 02.Security system for Houses - NFC Protect; Tomas Urban(HW), Martin Oravsky(WEB) 7
  - 03.Automated entry of vehicles into a logistics center; Ivana Mujgošová 8
  - 04.YPASS-Facility access management system; Matej Guráň, Jakub Chalachán 9
  - 05.GSM gate for opening the gate using your phone; Ondrej Kudláč 10
  - 06.Robotic Car; Erika Štefanková Černák David 11
  - 07.Car driver sleep detection during driving; Richard Pintér 12
  - 08.Dirty hands multimedia system control; Šimek Lukáš Šidlo Martin 13
  - 09.Intelligent Garden; Lam Tuan Anh 14

Lessons learnt 15
- Teachers experience: 15
  - From digital fabrication point of view. 15
  - From System Thinking point of view. 15
- PROS: 15
- CONS: 15

Outcomes 16

Sustainability 16

1. Short overview of the Pilot Action

- *One semester course for university students.*
- *It specialists should understand the IT systems from 3 domains-layers: Business Layer, Systems, Applications, Data layer and Technology layer.*
- *Systematic approach to solving solutions.*
- *Capability to understand the systems from the whole Life cycle from ideas to operations.*
- *The course provided general information about digital production technology.*
- *Students were guided how to realized solution from idea, intention, intention to project, project to prototype.*
- *All activities were documented in systematic way - as a side effect of the daily work - via modeling in professional modeler (Sparx systems-Enterprise Architect).*
- *Outputs of the course are intelligent documentation (model in common repository) and 3D solutions itself.*
- *Students got acquainted with different formats suitable for 3D printing.*
- *In addition to theoretical knowledge, students gained practical skills: how to use the rapid production prototyping of FabLab, how to use CAD modeling software, a vinyl cutter, laser cutter, 3D printer, 3D scan and print, CNC cutter, Manufacture of printed circuit boards*

Course contents:

1. Introduction - basic principles of FABLAB, why to think in holistic way.
2. SLCM - System Lifecycle Management, from idea to operation
3. System Thinking
4. Knowledge base management system based on metadata
5. IoT a Industry 4.0
6. Enterprise Architecture Frameworks a The Open Group Architecture Framework (TOGAF)
7. Basic principles and tools and work safety in FabLab
8. CAD computer aided design 2D, 2,5D, 3D.
9. Computer-controlled cutting.
10. Electronic construction.
11. 3D scanning and printing.
12. Computer controlled machining (CNC).

General information:

14 students in master level. 2 females, 12 males.

Student projects:

01.Smart sensors for Intelligent House; Rastislav Krchňavý, Michal Kren

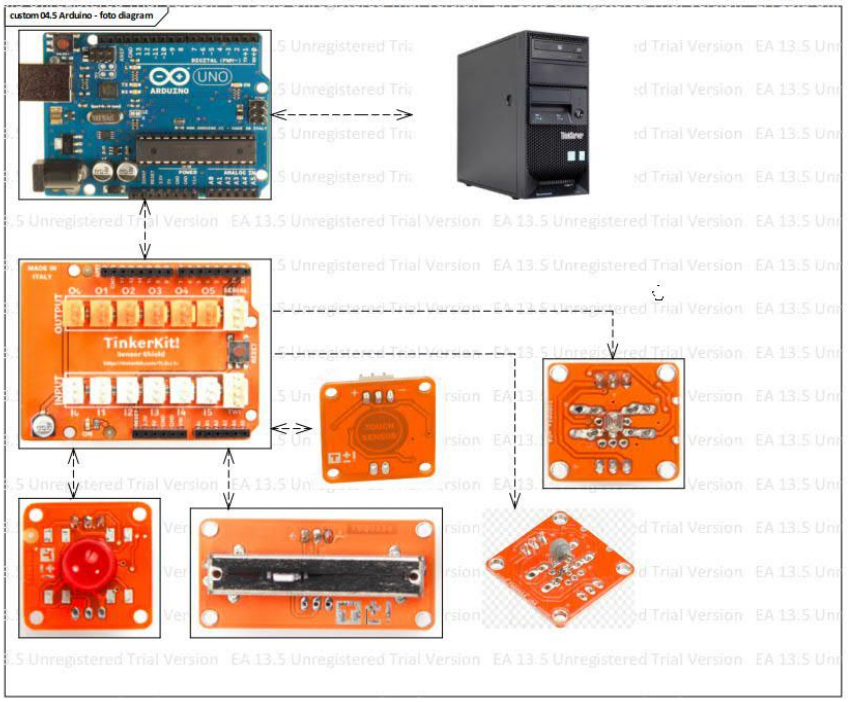
Description

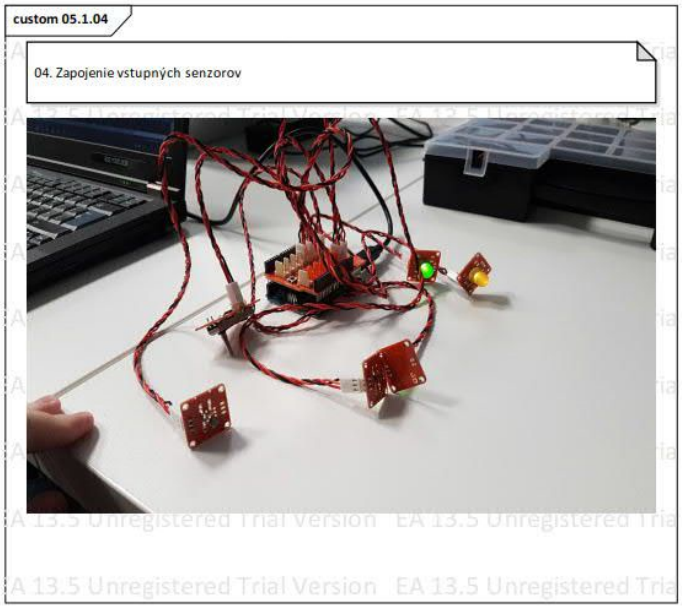
- Customers are households who want to monitor and evaluate data in the house.

Short Description: The sensor monitors the conditions (temperature and light) in the room and decides to turn the heating on or off. Cooking can also be controlled manually. Data from the sensor is stored on the home server.

Results

Small IoT with Arduino.


custom 04.5 Arduino - foto diagram
UNO
ARDUINO
TinkerKit!
OUTPUT
INPUT


custom 05.1.04
04. Zapojenie vstupných senzorov

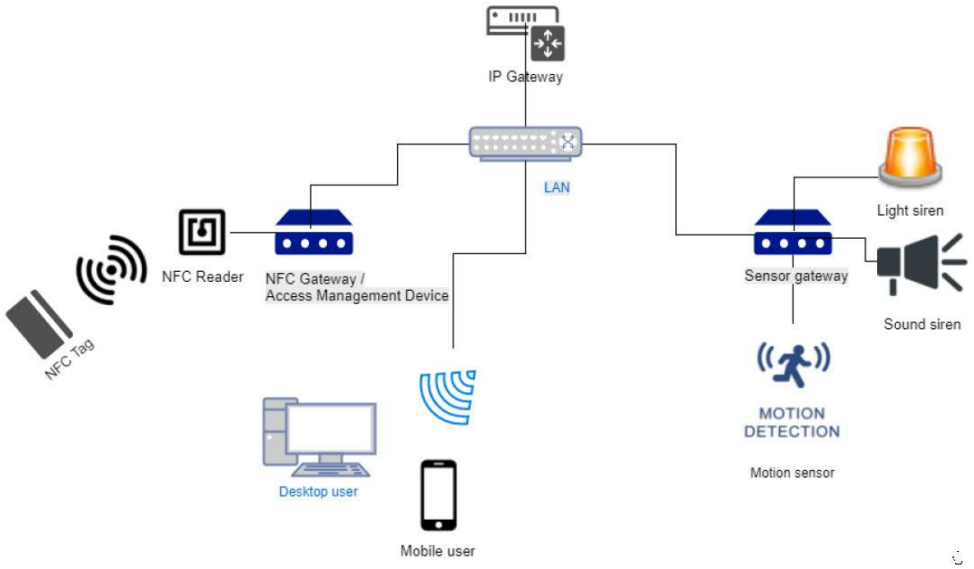
02.Security system for Houses - NFC Protect; Tomas Urban(HW), Martin Oravsky(WEB)

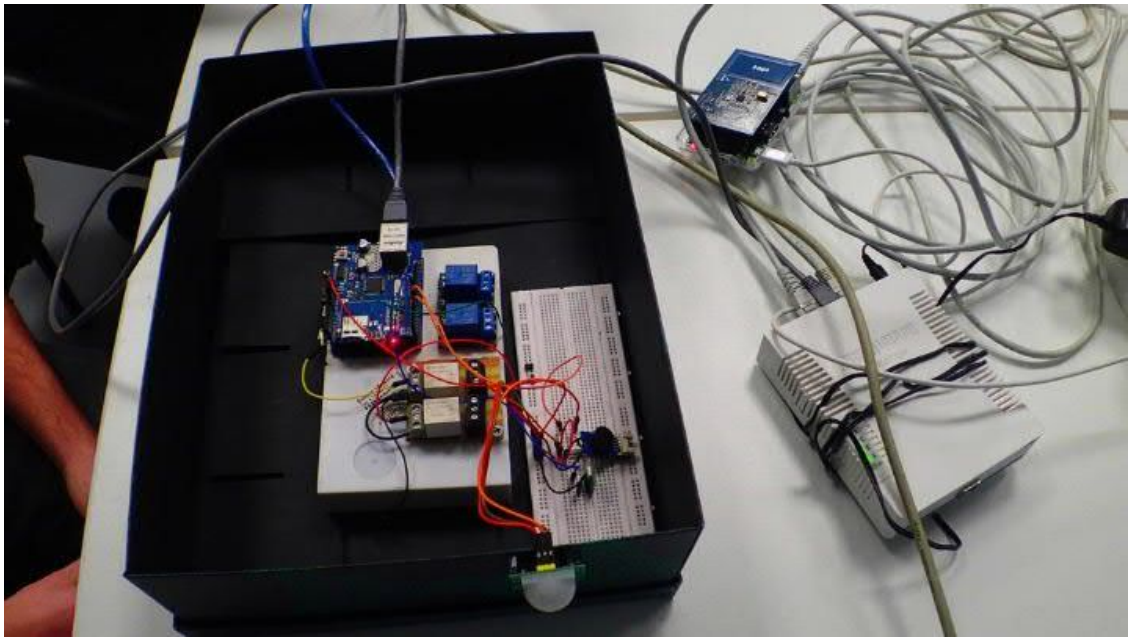
Description

- Customer: Every object that needs to be secured from home through the warehouse. Short Description: A motion sensor is installed on a stowed object to trigger the sound and light siren in case of a safe state. The secured object can be unlocked with the NFC chip

Results

- Running prototype with chipcard.





03.Automated entry of vehicles into a logistics center; Ivana Mujgošová

Description

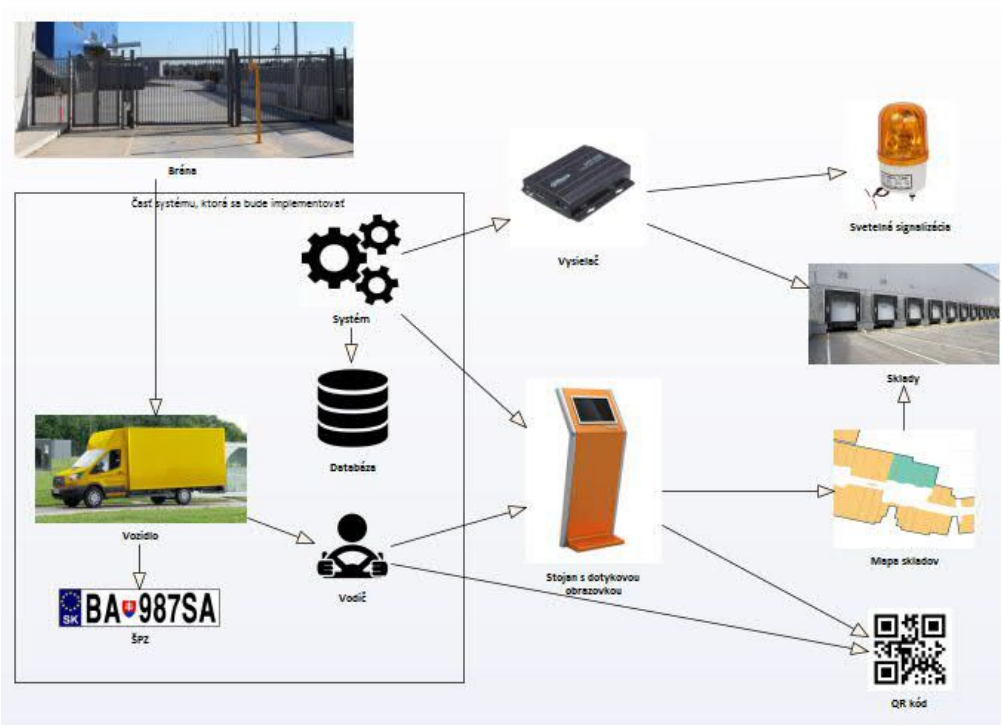
- Customer: Large logistics centers

- - Automated system for fast transport equipment.

- -Implementing part: scanning and subsequent escaping data from SPS.

Results

- Concept in EA, easy Web solution.



04.YPASS-Facility access management system; Matej Guráň, Jakub Chalachán

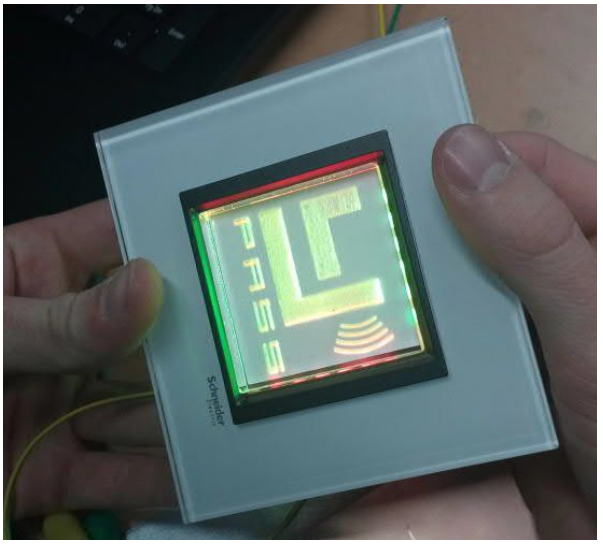
Description:

- Customer:
  - Ynet civic association and its members entering the reserved area
  - --

  Documentation of an existing card reader when entering the room. Also documented
  will be previous versions.

Results

- Relatively detailed model in EA on existing HW solution. Used methodology APVAssets-
  Perspectives-Views for describing existing status of the real system. This type of 'documentation' has the chance to be close the status 'up to date'.



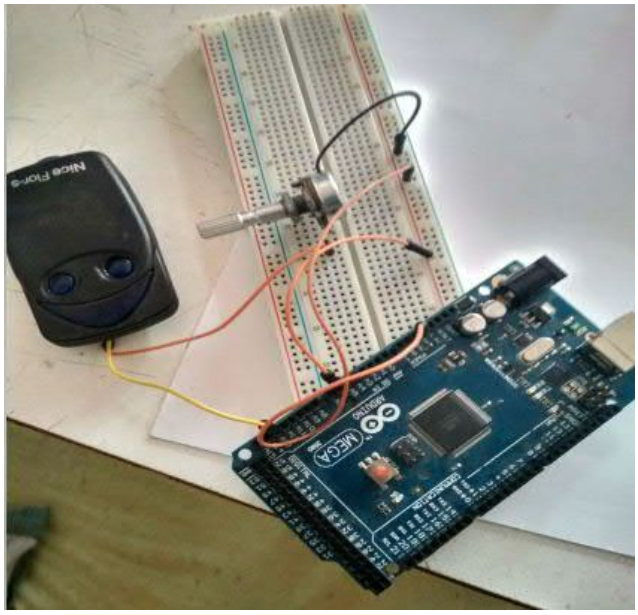
05.GSM gate for opening the gate using your phone; Ondrej Kudláč

Description

- *Customer: Kunov Garden Settlement III*
- *Extend the functionality of the existing gateway to open a mobile phone without interfering with the existing gateway infrastructure. Develop an external module.*

Results

- *Running system in prototype phase. Prepared for standard using.*



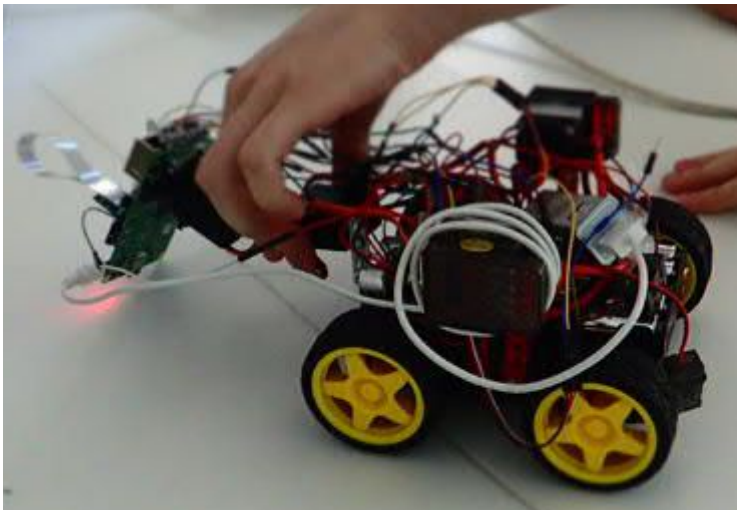
06.Robotic Car; Erika Štefanková Černák David

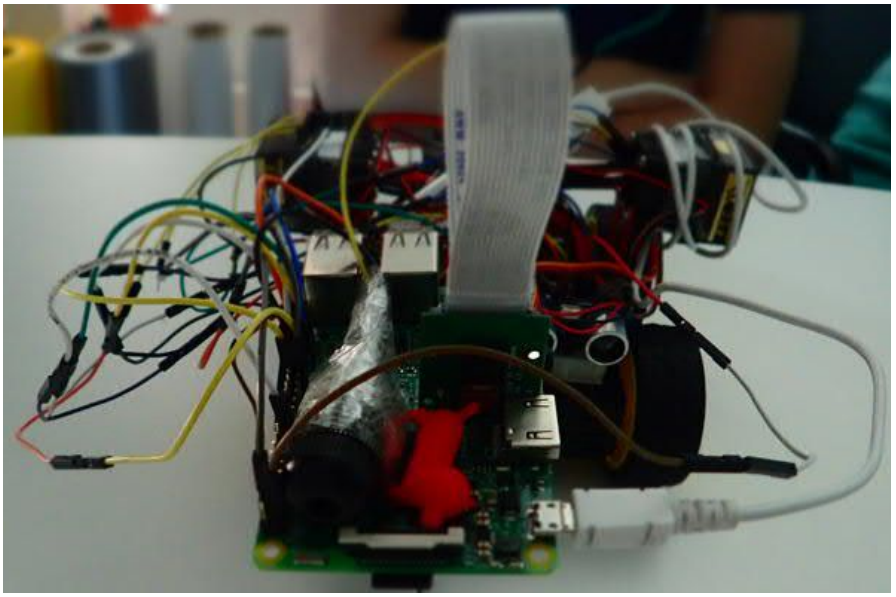
Description

- The goal of the project is to create a remote-controlled car that can be controlled without visual contact, thanks to real-time image transfer. To simplify control, increase user awareness and reduce the risk of collision, the user will be helped by various sensors such as distance sensor, gyroscope, accelerometer, temperature sensor.

Results

- Educational Functional prototype of the robotic car controlled via smart phone application and with many sensors.





07.Car driver sleep detection during driving; Richard Pintér

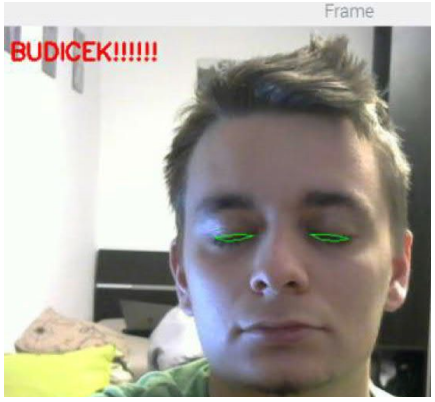
Description

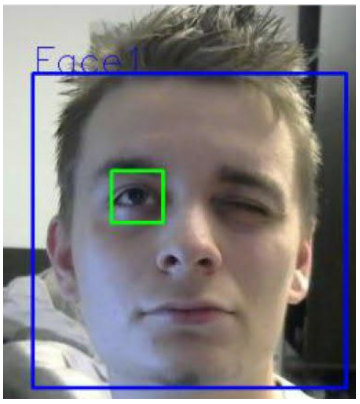
- Customer: All drivers, Ideal for Professionals drivers

- The goal of the project is to create a system that will capture the driver's face and watch his eyes while driving with the camera, and if the driver gets the microphone, the system will respond and the driver will signal a loud sound signal. The system will run on raspberry pi and will use either classic usb - webcam or raspberry at camera

Results

- Running prototype.





08.Dirty hands multimedia system control; Šimek Lukáš Šidlo Martin

Description

Customer:

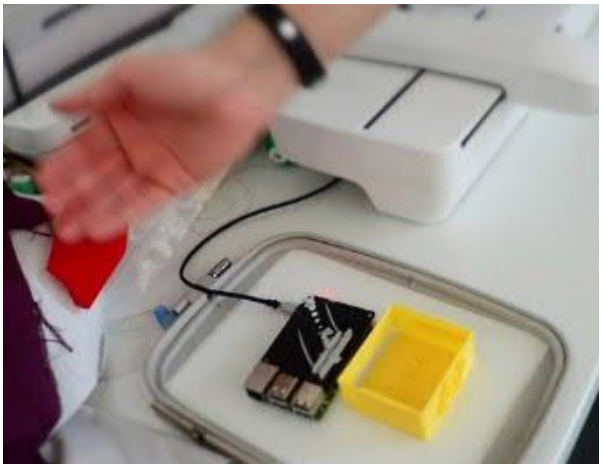
Users who listen to music and their work do not allow them to physically control the device.

Non-contact device used to control music by hand. Custom tuning of tracks and auto-start

time.

Results

Running prototype.



09.Intelligent Garden; Lam Tuan Anh

Description

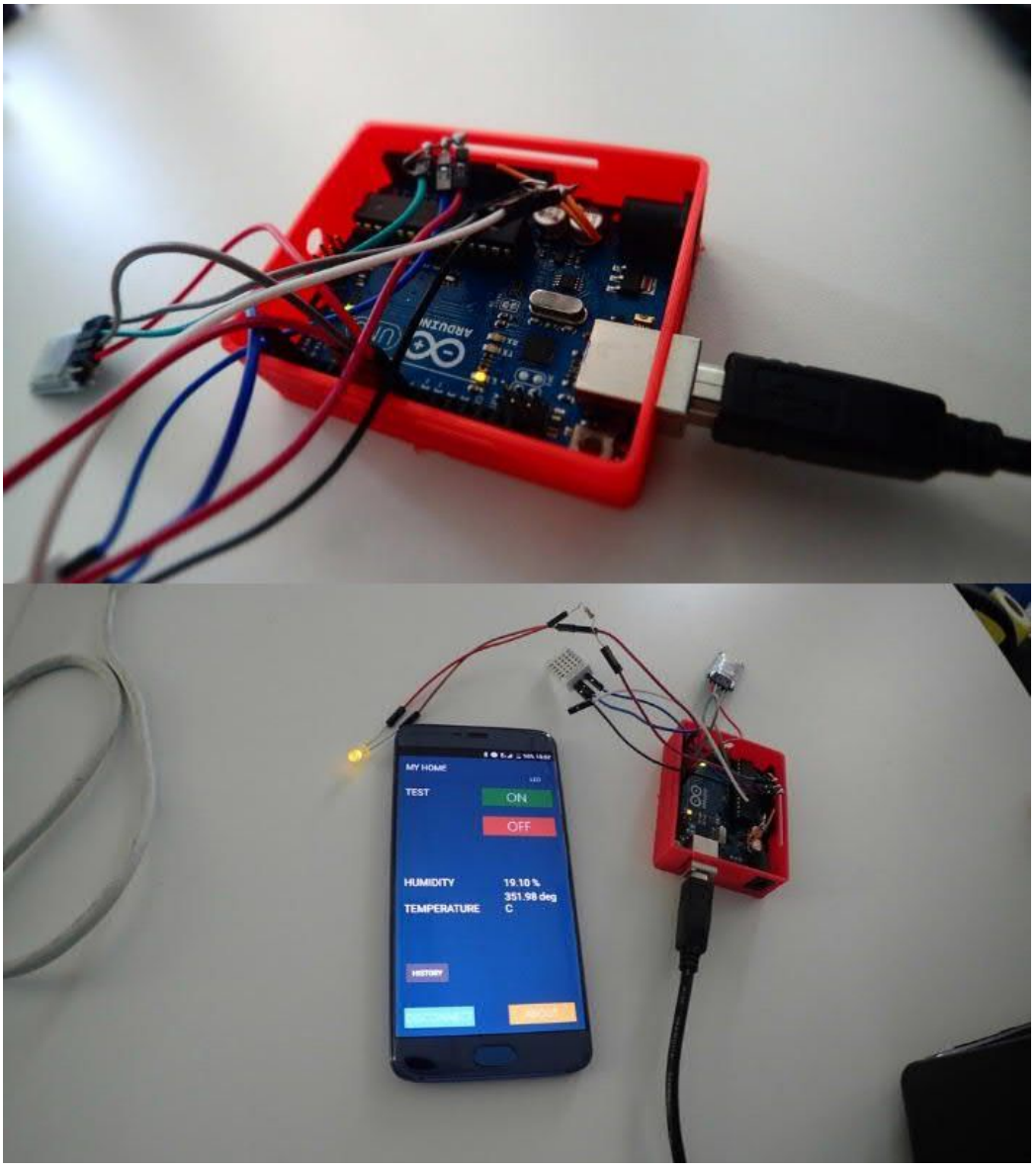
Customer: for himself.

- facilitating work on gardening
- The system checks the outside conditions for growing vegetables
- initially, a prototype solution is created in the size of a miniature aquarium.
- the target state - to create an auxiliary system on the area of about 2 hectares, in which

shelves will be grown vegetables

Results:

Running prototype. Documentation in model.



2. Lessons learnt

Teachers experience:

From digital fabrication point of view.

Many of students were excited by the ‘maker space’ with 3D printers and Laser cutter. As students of informatics, they had no opportunity to touch such devices yet. Some of them had experiences with Arduino, or Raspberry yet.

From System Thinking point of view.

- There is almost no habits to spent time with preparation before starting the work. The methodology ‘7D- Seven disciplines for successful solutions’ was presented to students. There is simple implementation in Sparx client – so called MDG. In spite of that, this methodology can be used independent the technology. It saves time for users and provide place in model structure for any piece of information which comes to ‘makers’ during realization of their project. It supports the awareness of team cooperation, knowledge sharing, and systematic approach.
- Many students knew EA just as schema builder. They were pleasantly surprised by many interesting features for keeping all information about their daily work on one place.

PROS:

- Interesting environment in the building of Comenius University´s Science Park – ‘maker space’ FABLAB CVTI.
- Many time it was the first experiences with digital fabrication
- Creative environment and approach to solve individual solutions from teachers
- Approximately 30-40 % appreciate the ‘Enterprise architect’ tool as a collaboration and knowledge management tool for managing all lifecycle of the solution. The can imagine to use it in the future. But they are aware of complexity of the tool.

CONS:

- Problems with licenses for EA client
- Non-traditional approach to the making documentation and totally new approach - ‘Model Driven Project’ from the beginning of the course
- Very complex tool for daily work
- Not enough devices for parallel working during class, e.g. 3 3D printers were not enough to satisfy 14 students during 3 hours

- Students expected stronger approach during the course to force them to deliver intermediate results

3. Outcomes

This course was created on the basis of cooperation between FABLAB CVTI and FIIT.
The main objective of the course was to bring students closer to digital manufacturing.
This course was focus on integration 2 approaches.

- *Rapid prototyping in the field of 3D printing, IoT, Laser cutter, CNC cutter and system approach. Students received the basic information about technology presented in FABLAB CVTI and*
- *general overview about holistic approaches in IT (TOGAF, ITIL). During the whole course we have used the client UML modeler 'Enterprise Architect' (Sparx Systems) and server background Sparx Cloud Services with WebEA access.*

Licenses for EA clients were provided by FIIT STU, licenses for WebEA access were provided by Sparx System company.
All Students had own project node in common repository. So, he could try to make use nontraditional using of EA client. Students were given the chance to try a team collaboration platform. This is crucial for building knowledge base management system, knowledge sharing, team collaboration, increasing the level of common understanding among all touched stakeholders.

4. Sustainability

'System Thinking' and 'Rapid prototyping'. Is it possible to use both approaches on the same course?
From the beginning the students were confused a little bit. Maybe there should be 2 courses. One course for system thinking, one for digital fabrication. In the first one the aim would be knowledge management, system approach, architectural concepts, making documentation. Second one would be part of systematical educational approach of all participants. In this manner we could develop e.g. the principles of self-learning teams.
Ideas for the future
Even we could try to verify the solution architects capability of the students by the test: in one course would the participant prepare the 'documentation' of the future solution and in the second class would the participant implement the solution designed by someone else.