Managing Innovations from Universities into Markets



THE4BEES Energy efficiency awareness for adolescents

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EU Interreg Alpine Space Project

Transnational Holistic Ecosystem 4 Better Energy Efficiency through Social Innovation







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EU Interreg Alpine Space Project

- **Target group**: educate a generation of energy aware citizens, starting with pupils and their schools \rightarrow long term perspective
- Idea: involve pupils in an interactive and interdisciplinary way
 - Visiting workshops, performing tasks, making analysis, creating story maps



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Introduction

- Facts: human dissipate energy resources
 - Energy wasters in schools are windows that are open for long periods, unnecessarily high heating temperatures, needless lightning and electrical devices in stand-by-mode (Bouslama et al. 2016)
 - Internal measures can help to decrease the overall energy consumptions up to 10% (BMLFUW 2014)
- **Methodology**: new ways and concepts are necessary to communicate the need for behavior changes
 - Using and combining different sensors to provide live information
 - Providing templates for the creation of storytelling maps
 - Let pupils experience and interact by their own and support them in doing this





Research Questions

Aiming at persuading pupils to save energy in schools

- How do you involve students in energy saving and let them tell stories about this in a way that is appealing and easily understandable?
- What should a concept that involves students in the different project phases and workflow stages look like?





Participating Schools in Salzburg

- Three partner schools in Salzburg (HTL Salzburg, BORG Oberndorf, HBLA Ursprung)
 - Five classes
 - Two diploma projects
- Age of pupils: 15 19 years







Concept and Workflow



SAVE ENERGY & CHANGE BEHAVIOUR

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Sensor Integration



Realization – Sensor System

Measure and observe

Collect real-time information in classrooms using different sensors

- Temperature (& humidity) sensor
 - Indoor/outdoor, heating system
- Window state sensor
 - Open/closed, tilted/open/closed
- Electricity sensor
 - Electricity consumption
 - Motion sensor
 - Detects if somebody enters/leaves the classroom
- Air quality sensor
 - CO₂ in three states
- Central base station
 - Control and configure all sensors











Home Automation

Using sensors to monitor and control buildings

- Generic term for systems in living spaces and homes aiming at:
 - Raising quality of living conditions
 - Safety
 - Efficient use of energy
- Based on linked and remote controllable devices/sensors and installations as well as automatable processes





Why is real-time important?

- Example: The "Is the cooker on?"-problem
 - You go to a conference
 - At the airport, you think: Is the cooker switched off??
 - Without real-time data: somebody has to drive home and check that
 - With real-time data: look at the phone \rightarrow the cooker is off





Sensor positioning



Where is the optimal location for the specific sensor?

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Sensor positioning

- Temperature and humidity:
 - The positioning has strong implications on the measurements!
 - Tips for sensor placement:
 - Not near doors or heaters
 - A little away from the ceiling
 - If a room feels warmer / colder than others, it may be due to the sensor placement
 - Solution: Move sensor or adjust temperature settings







THE4BEES: Example Class Room HBLA













THE4BEES workflow

IT Architecture Overview





Node-RED: Dashboard UI



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3 Visualization strategies







Analog vs. Digital? \mathbf{X} NO! \rightarrow Static vs. dynamic + many more!

- There are static web maps
- And there is this:



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How to communicate geoinformation?

Static Maps



- You can decide what the user will see (size, colors, scale, additional elements)
- Can be printed
- Can be used by everyone
- Looks the same for everyone and shows the same information
- Common map elements for orientation (legend, north arrow, scale bar)



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- No user interaction
- No dynamic information
- No input of additional media
- Might not be up-to-date



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Story Maps

- A Story Map is a simple web app to combine
 - interactive maps, multimedia content, and user experiences to tell stories about the world (Esri 2015)



Sources: https://www.wilsoncenter.org/sites/default/files/carroll_story_maps.pdf





Story Maps

- Using a Story Map gives you the possibility to decide
 - What the user will see
 - When the user will see it
 - Tell a story simultaneously to viewing the map
 - Combine it with multimedia content (images, videos, etc.)
 - Keep it interactive





How to create a good story map?



Think of who will be the audience



Make it exciting



Select the right template



Make easy-to-read maps





Source: https://storymaps.arcgis.com/en/five-principles/



How to create content for the map?

Example THE4BEES Building Models in 3D

- Pupils digitize their school buildings using a PDF plan and JOSM during an interactive workshop
- The model that runs in the background is used for further processing to visualize it in a 3D map



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How to create content for the map?

Example THE4BEES Building Models in 3D

- Map is generated using the ArcGIS API for JavaScript 4.5
- <u>https://developers.arcgis.com</u> /javascript/latest/api-reference /index.html





Examples Storytelling Maps THE4BEES BORG Oberndorf



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Examples Storytelling Maps THE4BEES HBLA Ursprung





All project partners



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Conclusion and outlook

- Pupils are motivated to **increase the energy efficiency** in their classrooms and to present results in form of **individual story maps**
- The pupils are **involved in nearly all project phases** in an interactive way (workshops and hands-on sessions, evaluations and feedback app)
- The focus until now was on the **development of the theoretical concept** and some **initial prototypes**
- A comprehensive **evaluation** of the concept and the prototypes is planned at a later stage within the THE4BEES project
- The **next steps** are **interactive workshops** with different kinds of **analyses** based on the data collected and to visualize the results into **story maps**



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