APPENDIX 4: HACKATHON

The Hackathon took place between 6th and 9th June 2017. It was mainly organized by the University of Applied Sciences of Western Switzerland (HES-SO). The core organization consisted of a team of three persons: Andres Upegui (Hepia/HES-SO), David Da Silva (Hepia/HES-SO), and Yuliyan Maksimov (FHNW).

During The Event

During these four days, there was full access to Workshops and every participant had access to the required infrastructure (hardware and software) for implementing his/her project.

Hackathon Iot Week.

Confirmed Workshops:

- STMicroelectronics
- Eclipse sensiNact and FESTIVAL platforms
- Fiware
- TagItSmart

AWARDS:

Awards were presented in the following criteria; Competitors were expected to present their project at the end of the event in front of a jury, that will then select the best projects to be awarded. Confirmed awards:

- The €5'000 IoT-Week Hackathon Siemens Award
- The 2'000 CHF (€1'900) IoT-Week Hackathon ABB Award
- The €1'000 IoT-Week Hackathon Hasler Foundation Award
- The €750 IoT-Week Hackathon FESTIVAL project Award

Moreover, all participants will receive for free an STM32 Nucleo development board from ST.

We established a guideline for judging the projects presented in the Hackathon. The goal is not to establish a score-based ranking, but to allow the jury to have quantitative tools to establish a common vision of the projects.

Originality: The problem identification and/or the proposed solution is original.

This means that the originality can be judged from the use-case application and/or from the technological point of view.

Impact of the solution in relation to SDGs: The project has the potential to have an impact on society by tackling one (or several) of the 17 Sustainable Development Goals.

Quality of the solution in IoT: The proposed solution exhibits a good quality respective to the State of the Art of IoT technologies. This means the overall system architecture is professional, the system is evolvable (new devices and functionalities can be easily added).

Work done during the hackathon: This refers to the amount of work performed during the Hackathon event. Some teams may have started their projects before the hackathon event, which is not forbidden. However, the goal is to evaluate the work really done during the event.

Use of the technologies presented in the workshops: The proposed solution makes use of the technologies presented during the workshops. During the Hackathon four workshops were presented to the participants to propose them basic building blocks for their projects. They were ST microelectronics, the sensinact platform (Festival project), Fiware and TagItSmart.

Demonstrator: The team presents a demonstrator which is the outcome of the work done during the hackathon. Keep in mind that the different projects have different complexities, so partial demonstrators can be also very valuable.

Feasibility: The idea and the technical solutions presented are realistic. The members of the team have a roadmap to allow their project to go further and have a real impact in society.

IoT-Week Hackathon Jury:

A jury selected the best projects following a demonstration session and presentations done by the participants.

The jury was composed of 2 award sponsors, 4 workshop lecturers, and 2 event organizers to have different points of view of the quality of the projects. They were:

- Mr. Alexandre Martin, Siemens
- Mr. Pablo Furrer, ABB
- Mr. Fernando Lopez de Aguilar, Fiware
- Mr. Erez R. Mizrachi, IoT-European Platforms Initiative
- Mr. David DaSilva Andrade, University of Applied Sciences and Arts of Western Switzerland
- Mr. Yuliyan Maksimov, University of Applied Sciences and Arts North Western Switzerland
- Mr. Bartosz Boryna, ST microelectronics
- Mr. Christophe Munilla, CEA – FESTIVAL project

Awarded Projects

Three projects were awarded by the jury during the closing ceremony. Here you find a resume of these projects:

BRB - Be Right Beach (1st prize)

Have you ever heard of Sardinia? It's a beautiful Italian island sometimes compared to paradise when it comes to its shores.

Costa Smeralda, Villasimius, Chia etc. everywhere you can find your perfect place, feet in the sand, just next to the sea. It is not easy, especially for a tourist, to find a destination for a day at the beach among almost 2000 km of free shores.

Be Right Beach is the application that helps the user to choose the right place to go for the best experience. The system suggests people not to go to a beach that is affected by pollution or overcrowding; moreover, sudden changes in water parameters or detection of a dangerous event can generate an alert useful for public authorities.

The system foresees two Control Units (CUs) for each point of interest (a beach or a site along the coast). The Sea Control Unit (SCU) is a buoy that monitors weather parameters such as water pH, turbidity, temperature and waves stirring. The Ground Control Unit (GCU) has a thermometer, a humidity sensor, an anemometer and a camera. The camera takes periodic pictures of the beach and estimates its crowdedness using computer vision and machine learning algorithms. Much attention is devoted to monitor the crowdedness that is a problem not only for the tourists, but also for coastal ecosystem. Moreover, the wave height and frequency can provide information for people safety (children especially) or useful for surfers.

Figure 47: Be Right Beach Presentation in front of the Jury

The collected data is sent to Lysis platform, implementation of the Social Internet of Things paradigm where every device has virtual counterparts. In the SIoT, objects establish social-like relationships between each other. The Social Virtual Objects (SVOs) can form their own social networks and share information in a trustworthy way. In this environment, the tourist's smartphone can receive information in a simple automatic way from the closest station and buoy.

The aim of the Be Right Beach project is to provide three different services:

- Touristic information about the best-desired beach: by selecting the parameters about crowdedness, wave status, water temperature and clearness, the application can provide a ranked list of beaches with the related path to reach them.
- Full management of the sensor network of stations and buoys for the relevant public agency: the whole sensor network is always available by means of a remote platform owned by the environment public department to evaluate the beach distress due to overcrowding.
- Provision of open data/big data services.

The first service is provided by the BRB application on the Lysis Market. Thanks to the social relationships among the users' smartphones, the stations and the buoys, the overall configuration is set up with any effort by the users.

The second service is provided by exploiting the bridging capability of the Sensinact platform. To this, the SVO source code has been upgraded by adding Sensinact API compatibility.

The third service is available by means of Fiware Context Broker (Orion). An extended API with support to NGSI protocol has been added to forward data to Fiware Orion. Our project targets Sustainable Development Goal 8 and 14. We also aim to make people aware of environmental problems such as sea and land pollution, to increase the quality of everyone's life and keep the coast clean.

FreeOcean (2nd prize)

FreeOcean is a system conceived to make oceans clean from near surface macro wastes. The idea consists in harvesting floating litter with huge nets dragged by specialized boats and/or trade ships already travelling in a specific area. Nets are then dropped and tagged with an emitter to keep a trace of its position, allowing a collector ship to pick the floating blob later. After the drop, a new collection phase is initiated by the harvester ship and the cycle continues until the latter runs out of nets.

The challenge here is to reliably monitor the net positions in a very hostile environment. We proposed to tag the garbage nets with buoys implementing an adapted long-range communication protocol based on the LoRa TM modulation. The standard protocol on top of the LoRaTM technology is focused on simplex communication; data flows from small site-specific devices to a generic relay hub connected itself to a greater network like internet.

Each relay can thus be a local star network, receiving data from devices. This topology is not possible in seas, where no relay is available and distances are too long. We propose a mesh protocol, merging low-level robustness and reliability of the LoRaTM modulation with the flexibility and scalability intrinsic of mesh networks. Leveraging the potential of such a system, we can keep a trace of the net position in a **mesh state**, each node having information about every other, thanks to an optimized state communication protocol, without any relay. Once a ship pass by any node, it can download the shared mesh state and have an updated view of the whole mesh.

Figure 48: Hackathon Free Ocean Presenters

During the Hackathon, we implemented a *Proof of Concept* of a mesh protocol based on the LoRaTM modulation. We need its capacity to implement FreeOcean, but the horizon scanning let us see a huge potential in fields such as environmental monitoring, wildlife tagging for scientific purposes, herd monitoring in no-network area (Brazil, Australia, etc.), or remote control of watering installations in wide area agriculture.

ThinkMilk (3rd prize)

In 2050, the world will need to produce 70% more food to feed an additional 2.3 billion people on the planet. Natural resources are limited and poverty is one of the biggest causes of environmental impact in the world. In the world, 570 million small and medium farmers don't have enough money or technical skills to manage the quality of their products.

Therefore, the milk harvested by them contains high rates of bacteria and somatic cell count, what makes it unfit to be consumed and so rejected by dairy cooperatives, causing the waste of thousands of litres of milk per day in the world, enough milk to feed the 795 million hungry people.

Moreover, small and medium farmers represent 58% of the gross worth of Brazilian dairy industry, evaluated in US$ 7 billion. Improving their revenues would bring incomes to 50 million of poor people in the country, helping the country to be closer to accomplish UN's 9th goal, "Industry, Innovation and Infrastructure".

On the other hand, laboratories control bacteria and somatic cells in milk samples using chemical analysis. This method is expensive (weekly tests are done using samples from each cow's milk), slow and produce laboratory waste. Considering 97% of the drinkable water in Brazil comes from aquifers and the country has several problems to manage its waste, Thinkmilk is focused on bringing technology to achieve responsible production in milk harvesting, as UN expects with its 12th goal, "Responsible Consumption and Production". The technology consists in an embedded system composed by two modules: first, a portable device to check the milk substances rate (fat, protein, lactose) and the presence of zoonoses (mastitis, tuberculosis and brucellosis) in milk samples.

Second, a wearable device resistant to environment conditions used by cows to check their geolocation and vital signs (heartrate, blood pressure, body temperature, stress, heat, etc.). It will be developed based on a STM32 MCU Nucleo platform and using sensors like thermistors, pulse sensors and inertial sensors.

All the collected data is stored in the cloud, based in FIWARE platform (cloud hosting, interface to networks and devices and data management) and can be easily accessed by the farmer or by the authorized veterinarians using an intuitive app for smartphones,

programmed in Python. It also generates analytics and graphs that can help the farmer to improve the quality of the milk and to quickly prevent the herd in case of risk of diseases and epidemics in the region.

Thinkmilk innovates by offering an intelligent and physical technique that reduces laboratory waste produced in traditional analysis, being safer to the environment and allowing data gathering to generate instant diagnostics and forecast by matching milk diseases and vital signs of cows with the use of machine learning.

It impacts the milk production completely, helping farmers to offer a good quality product to the market, allowing dairy cooperatives to pay the right value for milk according to its yield quality and gathering analytics to help government regulatory agencies, providing an overview on focuses of zoonosis, allowing them to take preventive actions and saving time and money usually spent in field researches.

Figure 49: Hackathon Winners