Where Science meets Business

BIO-ICT, as the first Centre of Excellence in Montenegro, is a consortium of excellent research institutions that creates a specific innovative ecosystem focused on development and implementation of novel bioinformatics technologies. This, for the country unique partnership has been exploiting its capacities towards unlocking and utilizing potential of the Montenegrin South Adriatic Sea and inland rural areas, bringing innovative solutions in various bioeconomy sectors, related to *sustainable food security, blue growth, bio-based innovation for sustainable goods and services*. At BIO-ICT we combine specific scientific and innovative expertise in information technologies, life sciences, ecological monitoring. Through synergy with industrial partners, BIO-ICT research institutions are progressing towards the goals of translating research results into innovative products and services for boosting economic and social development, bringing into focus the environmental protection.

Besides the Faculty of Electrical Engineering, partners on the project are three leading Montenegrin research institutions: Biotechnical Faculty, Institute for Marine Biology, Institute of Public Health; two international universities: St. Petersburg Scientific Research Centre for Ecological Safety from Russia and Centre for TeleInfrastruktur (CTIF) from Denmark; and two successful Montenegrin SMEs companies: COGIMAR and Green House Jovović.

In every area of the contemporary business world, progressive companies face an ever-increasing demand to innovate. We at BIO-ICT believe that Montenegro is a prime location for research and development. We are creating an environment for the productive collaboration between industry, academia and government agencies. All stakeholders working together will position Montenegro as a knowledge-based economy and as a primary location for RD&I.

Our aim is to create an open, welcoming and vibrant centre that will inspire our teams and partners to push the boundaries of scientific innovation.

Please find here our major achievements so far and join us with new and inspiring ideas and models for collaboration.

BlueLeaf platform

BlueLeaf platform is developed within BIO-ICT and the team of researchers from the Faculty of Electrical Engineering who worked on it. "BlueLeaf" is IoT platform. This platform enables its users to easily send data from various sensors to the cloud. The data are stored in a database and are graphically presented to users. The data can also be exported in different formats (json, csv/xls). The solution has been implemented using open source tools: Linux, LAMP stack, PHP programming language, and Laravel framework. The data integration has been tested using sensor nodes based on Arduino, Raspberry Pi, Libelium Plug and Sense, and PC. The solution is open for further development with respect to additional IoT protocols, data types, and interfacing to analytics tools.


SEMaR system

SEMaR system is the representative example how new ICT solutions, using technological concepts of Internet of Things, can improve ecological monitoring of sea water and air parameters that include water temperature, water pH level, air temperature and air humidity. After the data is measured it is transferred to the data center and visualized on cloud based BlueLeaf platform. The system has been implemented using open source electronics tools such as: Arduino platform, GPRS module, solar panel and low-consumption and waterproof sensor probes.
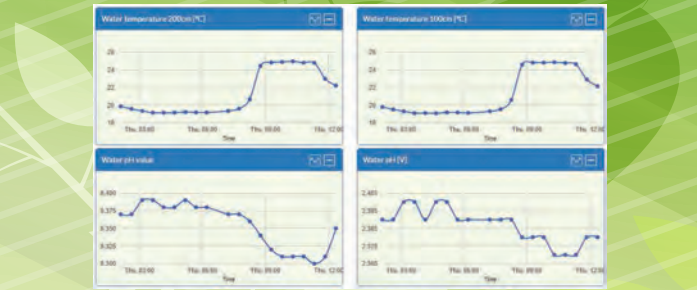
Digital Soil Mapping

Digitalization of the soil database has been done for the first time in Montenegro by BIO-ICT researchers. Soil database of Montenegro, which contains values of physical and chemical parameters of soil, is used for clustering. Clusterized soil data has been presented on dynamic map and compared with existing pedologic map made by human experts. In addition, by using spatial interpolation distance weighting and results of K-means clustering, different types of thematic pedologic maps were made and integrated into WEB application.
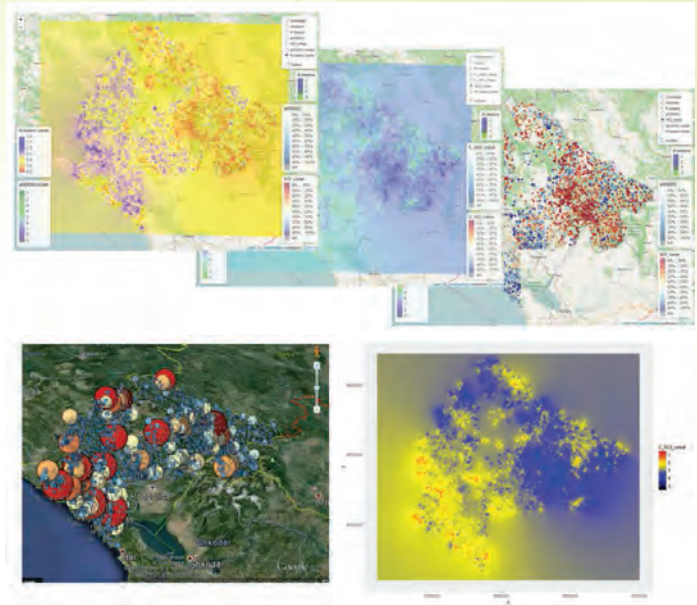
Smart irrigation system

We are testing this system at the field of our commercial partner Green House Jovović. Smart irrigation system allows easy and flexible irrigation process by providing optimum water consumption according to the needs of the plants. The most important input parameters of the algorithm for smart irrigation, in addition to soil characteristics, are moisture and soil temperature, humidity and air temperature and plant's tissue humidity. The collection of these data is allowed by using Wireless Sensor Networks (WSN). Based on the obtained data, using the specially developed algorithm for smart irrigation, main controller unit determines the moments of switching on and off solenoid valves that regulate the flow of water. The system for automatic control of the irrigation is developed and it will be upgraded later with the algorithm for smart irrigation and WSN. It provides the possibility for users to configure the time schedule for irrigation, where the closing of the valves can be scheduled based on the duration of irrigation or amount of water that is released. Configuration and control of the system can be performed manually, on the main control unit, or remotely, by commands sent over the SMS service. Information about current configuration and amount of released water are sent to the user by SMS report and to remote server for further analysis and graphical presentation. The main control unit can be remotely configured using the Android application, providing easy and flexible control of the irrigation process.

BIOPORTAL - http://bioportal.me/

Bioportal.me is portal intended for farmers and people who buy their products.

Portal consists of four parts:
- Agromar Market
- Agricultural Issues
- BIO-ICT services
- Advertisements

Currently, Agromar market is in the development phase. It allows agricultural producers to sell their goods to users of the portal. The whole system Agromar market contains several types of profile, like profile for farmers who offer goods, profile for customers. Also, the portal notifies by mail in exactly defined time sellers and suppliers about their orders. Customer has a number of options, such as ratings of products obtained, commenting etc.

Food Chemistry

At the Institute of Public Health laboratories we are conducting researches about food chemistry. Macronutrient components of commonly used vegetables are determined as well as micro-nutrients components. Since, antioxidant components are very popular in a present time among food and nutrition chemistry, we have been developing strategies of different sample preparation for antioxidant analysis. From literature we get methods for antioxidant analysis using spectrofotometric and HPLC (MS) techniques (available equipment from IPH). Also, currently we are trying to activate sulforafan from fresh, frozen and lyophilized collard green samples in order to provide a process that produces a collard greens supplement or concentrate with high levels of sulforafan.

Controlling diseases at Montenegrin Vineyards

BIO-ICT researchers from Biotechnical Faculty are working at their experimental field and laboratories on method develop-ment to determine possible resistance in certain plant patho-genic fungi towards the most frequently applied fungicides in some of the agricultural crops.

For better control of diseases in Montenegrin vineyards, researchers develop measures for preventive protection in order to reduce the utilization of plant protection products. The required data are collecting from meteorological stations and after that processing in a proper way. Based on these data and observations made in a vineyard, real possibility for realization of the infection is assessed.

Ecological Monitoring

Biomonitoring of heart rate and behavioural activities of mussels performed by Institute for Marine Biology started in April 2016 year on the mussels and fish farm of our commercial partner COGIMAR. Biomonitoring based on physiological and behaviour parameters is performed for the first time in Monte-negro, as well as in the Mediterranean. Biosensor monitoring can provide daily insight into the marine ecosystem state.

In the area of marine ecology and chemistry, qualitative and quantitative analyses of phytoplankton were performed as indicators of water quality. And it was also identified that phytoplankton organisms are toxins producer. In area of integrated multi-trophic aquaculture (IMTA) we get data about how fish farming influence on mussels farming in integrated system and compare it with monoculture mussel farming. Important part of investigation is analysis of shells biodivesity in the Boka Kotorska Bay, which will be base for introduction of new species in the farming process, diversification.

University of Montenegro

CENTRE OF EXCELLENCE IN BIOINFORMATICS

Faculty of Electrical Engineering

"Green house - Jovović"

cogimar

SRCES RAS
Saint-Petersburg, Russia

CTIF

World Bank loan

For more information on BIO-ICT Centre of Excellence, please find us on Web www.bio-ict.ac.me, Facebook, Twitter, LinkedIn.