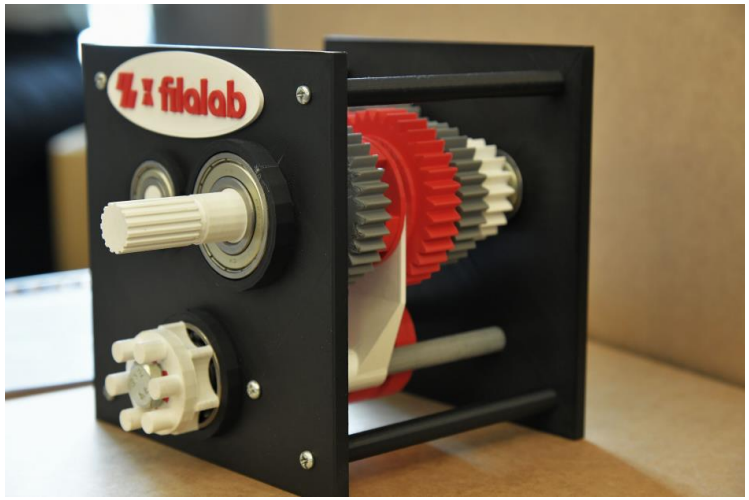
VILNIUS TECH
Vilniaus Gedimino technikos universitetas

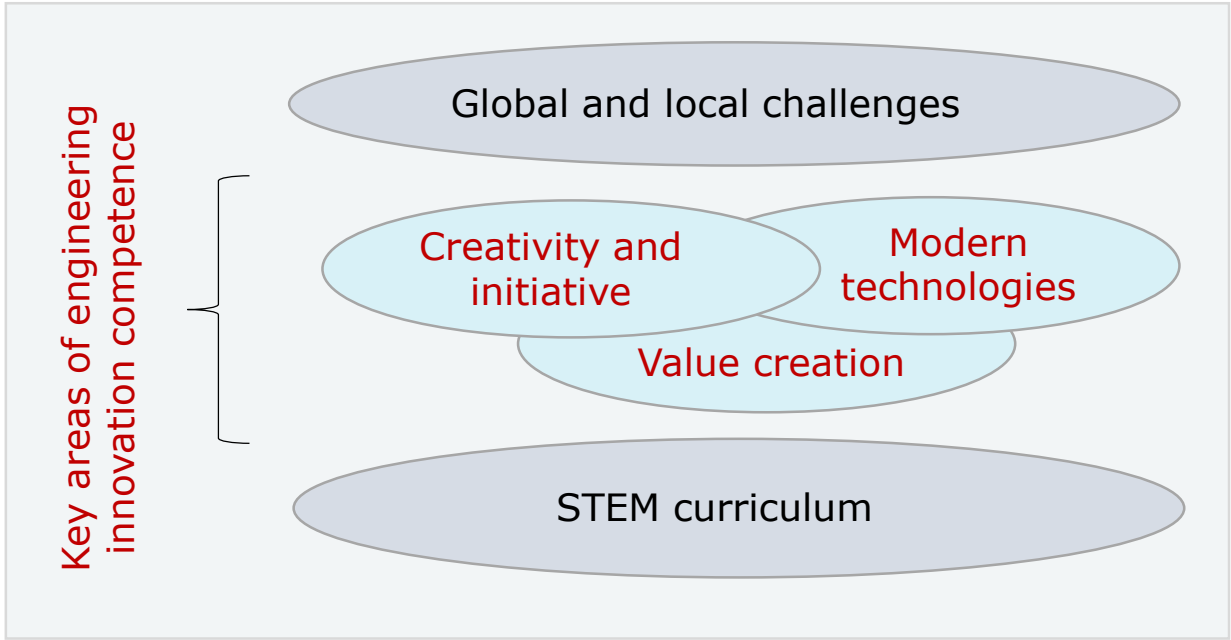
VILNIUS TECH Distance Learning Platform FUTURE ENGINEERING

BETT London
29-31/03/2023

STEM and engineering innovation at school

Engineering innovation is of decisive importance for the sustainable progress of society, so the consistent education of professionals in that field must begin at school, just like the education of sports or arts professionals.





In STEM education, engineering integrates and applies all other STEM disciplines, assuming unlimited number of topics for students‘ interdisciplinary research and creative projects focused on problems in their environment.

Platform FUTURE ENGINEERING (1)

Distance learning platform FUTURE ENGINEERING of the VILNIUS TECH university (FE platform, *https://ateitin.vilniustech.lt*) is designed for the problem- and project-based learning aimed to develop students' basic knowledge and transferable skills needed for engineering innovation.

Since 2017, the FE platform has been providing free opportunities for students of grades 7-12 to carry out interdisciplinary project works in the field of engineering and other STEM disciplines, focused on research and practical solution of real problems in their environment.

Platform FUTURE ENGINEERING (2)

Features of the MOODLE-based FE platform include:

- digital learning content and tools,
- interdisciplinary project works,
- contact and remote consultations, public presentation and competitions of completed works,
- events for professional guidance,
- involvement of teachers and their training,
- involvement of consultants - university professors, scientists and social partners.

FE results in 2017-2023:

- 20 educational subject areas;
- 3,200 students from all over the country participated;
- 700 project works completed;
- 330 teachers trained.

FE subject areas in 2022/2023

1. The city of the future: a sustainable living environment.
2. The city of the future: sustainable building.
3. The city of the future: environmental protection.
4. Android app development.
5. Application of artificial intelligence.
6. Design technologies and innovations
7. Making a movie with a mobile device. School TV.
8. Biomedical engineering.
9. Product modeling (AutoCAD, Fusion 360, etc.).
10. Smart greenhouse.
11. Casting technologies in the production of parts.
12. Prototyping a robot (Arduino, etc.).
13. Digital manufacturing (FabLab).
14. Construction - in practice.
15. A modern car.
16. Green energy.
17. Investment solutions using the Luminor Investor.
18. Business plan using the Canvas method.
19. Virtual reality technologies.
20. Virtual currencies: bitcoins.

FE project works (1). Subject areas: ARTIFICIAL INTELLIGENCE and ANDROID APPS

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Cell Detection Using Artificial Intelligence

Author: *Aleksandras Samonov.*
School: *Vilniaus licėjus.*
Supervisors: *IT Teacher Darius Šimkus.*
Consultant: *Lect. Antanas Zinovičius.*
FE Topic: Application of Artificial Intelligence

ANNOTATION

Artificial intelligence plays an important role in many fields, including medicine. One of the directions of applying artificial intelligence in medicine is cell recognition, which reduces costs and increases the efficiency of systems.

MAIN PROJECT PARTS

Stages of work:

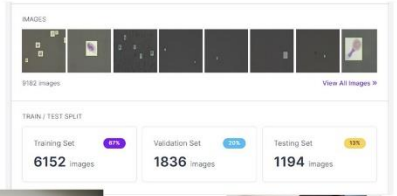
1. *Acquiring theoretical knowledge of artificial intelligence.*
2. *Searching for an object recognition and categorization model.*
3. *Collecting initial data.*
4. *Processing data to prepare a database.*
5. *Training the model using the compiled database.*
6. *Combining the model with a mechatronic system using the "NVIDIA JETSON NANO" microprocessor.*

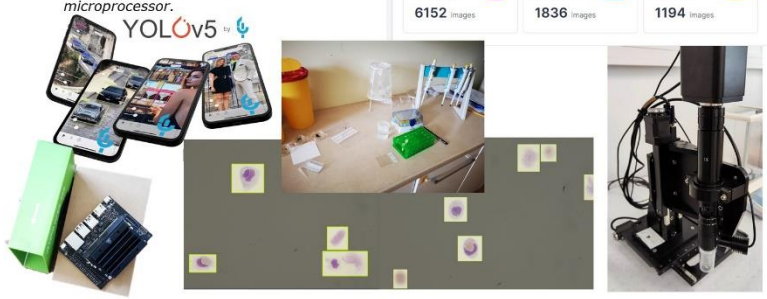
GOAL AND OBJECTIVES

***Goal** - to create an Artificial Intelligence that could recognize various types of cells and calculate their quantity.*

OBJECTIVES:

1. Familiarize with the theory and practice of developing artificial intelligence.
2. Acquire practical skills in creating and adapting databases.
3. Create a training model for cell recognition.





RESULTS

In developing an innovative solution for cell recognition, we tested more than one object recognition and categorization model, with YOLOv5 model being the most suitable. We collected data from the internet and laboratory using optical microscopy. We learned how to create a database using the "ROBOFLOW" system and train the model in the "Google Colab" environment. In further stages of work, we will combine the model with a mechatronic system using the "NVIDIA JETSON NANO" microprocessor.

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Development of ANDROID Application

Authors: Laurynas Dulskis, Nojus Danys, Kotryna Stancikaitė, Goda Zabarauskaitė, Evelina Zmejauskaitė, Ignas Maliauka
School: Vilniaus Radvilų Gimnasium
Supervisors: IT Teacher Živilė Ringelienė, Math and IT Teacher Aidas Milius
Consultant: lect. Dovilė Kurpytė
FE Topic: Android APP development

ANNOTATION

The created app allows people to actively explore the city of Vilnius through a game in which it is possible to visit one hundred locations in Vilnius. Points are awarded for each visited location. By collecting enough points, the user can unlock a fragment of a photo of the city of Vilnius.

GOAL AND OBJECTIVES

Goal – to create an Android application for exploring the city of Vilnius.

Objectives:

1. Create a user interface and an algorithm;
2. Write the code for the application;
3. Perform testing of the program.

Discover Vilnius Application

Programming language - *JAVA*
Server - *PHP* and *MySQL*
Presentation - *Microsoft Word, PowerPoint* ir *Excel*

01 Choice
There are as many as one hundred points that you can collect and places to visit.

02 Exciting Game
While playing the game, you will be able to explore the most beautiful and interesting places in Vilnius.

03 Map
Easily understandable and well-known Google Maps map for everyone.

04 Simple Design
Simple and intuitive design

CheckBox
When the box is clicked, a list with three options expands. You can choose which points you want to see: only the collected ones, only the uncollected ones, or all of them.

Button for collecting points
When you are close to a certain location and press the button, points are collected.

Choice
Many different options to visit favorite places.

Navigation
An easily understandable and universally recognized menu navigation.

RESULTS

A modern-looking Android app has been created that allows Vilnius city residents and tourists to explore the city. The map marks a hundred noteworthy places in Vilnius. The app's code is written in the JAVA programming language. The PHP programming language was used to create the server program, and MySQL databases were used. In the future, you will be able to find our app on the Google Play Store.

Google Play

FE project works (2). Subject areas: DESIGN and FABLAB

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NIGHT LAMP "HOT AIR BALLOON"

Authors: *Agnė Virkutytė, Gabija Matkutė and Laura Adukauskaitė*
School: *Kėdainių šviesioji Gimnasium*
Supervisors: Art Teacher Jolanta Issa
Consultant: *Assoc. Prof. Dr. Linas Krūgelis*
FE Topic: *Design technologies and innovations*

"Study the science of art; Study the art of science." - *Leonardo da Vinci*

ANNOTATION

A night lamp with an attractive design has been created, which will create a calming and dreamy atmosphere in the room and help to fall asleep easier. A video camera is built into the lamp, allowing parents to monitor their child's sleep.

GOAL AND OBJECTIVES

***Goal**: Create an attractive design night light that would emit a soft, sleep-friendly light and allow one to observe a sleeping person from another room.*

Objectives:

1. Create a cover resembling an antique hot air balloon;
2. Make holes in the cover so that light would be dispersed into small beams of light;
3. Install a video camera.

MAIN PROJECT PARTS

The design concept of the lamp was born while sketching. In one of our explorations, we drew a hot air balloon. The hot air balloon symbolizes a dream, childhood, and the fulfillment of desires.

We constructed the lower part of the lamp from spaghetti ropes, thus imitating an ancient hot air balloon basket. For the construction of the upper part, we chose a balloon and covered it with a quick-drying plaster mixture. To scatter the light beam, we drilled holes with an auger. We used pipe fittings to connect the lower and upper parts.

RESULTS

We managed to create a unique lamp that diffuses light and not only serves as a great interior detail, but also performs an important function of monitoring children. In today's market, preference is given to multifunctional items, and devices that secretly monitor children always remain in demand. However, in improving the design based on feedback, the goal is to reduce the visibility of the video camera.

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"GREEN WALL" IN THE BIOLOGY CLASSROOM

Authors: Adrijus Muleronka, Augusta Chlomko, Vilte Čepkauskaitė, Elinga Daugilavičiūtė, Austėja Juknytė.
School: Jonavos Jeronimo Ralio Gimnasium.
Supervisors: Biology Teacher Idilija Balickienė, IT Teacher Angelė Buitkienė.
Consultant: *Assoc. Prof. Dr.* Vilunė Lapinskienė.
FE Topic: The city of the future: sustainable building.

ANNOTATION

The project work is aimed at determining how air quality changes when green plants are grown in a room. A project was prepared, and a "green wall" was established, planted with plants. CO_2 concentration measurements were taken in a classroom without plants and after installing the "green wall", quantitative measurement data was provided.

Calculations were made to determine how much the concentration could be reduced as the surface area of the plant leaves increases, i.e., as the plants grow.

GOAL AND OBJECTIVES

Goal - Perform a CO_2 study in the biology classroom and determine how air quality changes by installing a "green wall".

Objectives:

- Design and install a green wall in the biology classroom;
- Conduct CO_2 concentration measurements in the classroom before and after the installation of the "green wall"
- Calculate how much the leaf area of plants needs to be increased to prevent CO_2 concentration from exceeding 1500 ppm.

MAIN PROJECT PARTS

1. Design and installation: Adrijus completed the tasks. Father was consulting, the work took place in the company MB „Vaikystės pasaka".

2. The collection of information pertaining to plants and vessels. Plastic vessels, made entirely from recycled plastic and featuring an integrated watering system.

Plants - Asparagus, Snake Plant, and Fern.

3. CO_2 Measurement of concentration in the biology classroom. Measurements were taken before the installation of the green wall and after the installation of the green wall under identical conditions in a closed environment:
30 minutes before class without students,
after the first class with 23 students,
after the second class with 23 students.

4. Calculation of Green Leaf Area.

After conducting measurements of CO_2 concentration, we have determined that with a plant area of around 8.5 m^2, the CO_2 concentration changed by 5%.

It has been decided to calculate how many times the green wall's plant leaf area would need to be increased to achieve a classroom CO_2 concentration of 1500 ppm.

Planting plants on the "Green Wall"

Two "Green Walls" have been installed at the back of the classroom, and one is located on the side near the window.

RESULTS

1. A "Green Wall" has been designed and installed in the biology classroom.
2. After conducting measurements of CO_2 concentration before and after the installation of the "Green Wall", it became apparent that the concentration of CO_2 decreased insignificantly due to the relatively small size of the plants and their small leaf surface area..
3. An approximate calculation suggests that increasing the current plant area by a factor of 5.4 would result in a decrease of CO_2 concentration to the recommended hygiene level.

CONTINUATION OF PROJECT

It is planned to continue to evaluate not only the differences in CO_2 concentration in classrooms but also to investigate microclimate parameters, the well-being of students and teachers, as well as to plan green areas in various spaces of the gymnasium.

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Summary

The six-year experience of the FE platform has proven that it can be considered an optimal solution for strengthening STEM interdisciplinary education, providing the basic knowledge and skills needed for future engineering innovation professionals.

Needs for further development of FE:

international networking and partnership in various areas of development of the problem- and project-based STEM distance learning solutions would be welcome.

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