TEMPLATE for BEST PRACTICE EXAMPLES

1. **Name of the project:**
   Sunflower

2. **Subjects covered from STEAM areas:**
   Programming
   Electronics
   Mathematics
   Renewable energy
   Art
   Modeling

3. **Target group (age range and size of the group):**
   For high school - from 15 to 19 years, a group of 10 students

4. **Duration of the activity:**
   a) One modeling workshop in 3D modeling software
   b) One workshop for printing 3D models
   c) One workshop for connecting all electronic components
   d) One workshop for assembling sunflowers from components
   e) One programming workshop

Each activity lasts 90 minutes. Preparation for each activity requires 180 minutes.

5. **Key words:**
   Electronics, programming, modeling, solar tracker

6. **Key sentence describing context of the activity, followed by short description (200 words):**
   This is a learning activity in which students will learn to apply microcontrollers to control motors, learn about the importance of renewable energy sources in the future, how solar panels work, design and assemble their own mechatronic system for efficient solar energy collection.

   Students will first learn to model in modeling software by practicing geometry and physics and thus forming their own petal model. This will prepare them to use a 3D printer. They will learn to connect electronic components, form and read an electrical circuit. They will learn to use the Arduino uno development environment and program in it. This project enables students to practice and apply the learned skills in the field of electronics and energy while solving problems and making decisions based on their own knowledge, creativity and imagination in order to achieve their goals.

   This project is designed to encourage students to create their own mechatronic system. Students will make assemblies and subassemblies of devices for monitoring the

position of the sun. While students connect, they also learn important mathematical concepts, physical laws, converting one type of energy into another, learn about the importance of saving electricity that will help them throughout life. The project aims to focus on controlling DC motors depending on the information the controller receives from the sensor but there are so many other learning elements that include test-based learning, problem solving, collaboration, communication, self-learning and more.

7. **Description of the activity environment, including the list of materials and tools needed:**

   Formal activities are performed at school, in makerspace, where students practice their knowledge of mathematics, physics, programming, mechatronics. Also, evaluation activities were conducted in the school environment.

   Resources required:
   - Arduino uno controller, 4 photoresistors, 2 servo motors, lithium ion battery, solar panel, display switches, supporting structure (from available materials)
   - Computer with internet access, projector, 3D printer, paper, cardboard, scissors, glue, pens, paints…

8. **Step by step, detailed description of the activity, including teaching and learning strategies:**
   - Students have a dialogue with the teacher and with each other about the application of previously learned mathematical concepts and the laws of physics, the use of libraries for servo motors
   - Students participate in workshops and learn about the importance of saving electricity
   - Students learn about electronic components, circuit, resistors by connecting a solar tracker
   - Students draw petals on cardboard as an addition to the tracker in art classes
   - Students prepare files for 3D printing of their petals
   - Students learn about renewable energy sources through a solar tracker with petals
   - Students give suggestions for further research on the topic

   During this scenario, students will explore:
   - principles of servo motor operation
   - microcontrollers
   - photoresistors
   - batteries
   - energy
   - the aesthetic value of the device

9. **Learning objectives/competencies:**
   This workshop describes how to explore a mechatronic system (a combination of mechanical, electronics, electrical engineering and informatics) with the help of

practical activities. The described activities can be used to connect electronics, renewable energy sources and art. Workshops could be realized in regular school classes as a project.

Domain-specific goals are learning about:
Plane Geometers
3D Shapes
principle of servo motor operation
microcontroller
photoresistor
battery
energy

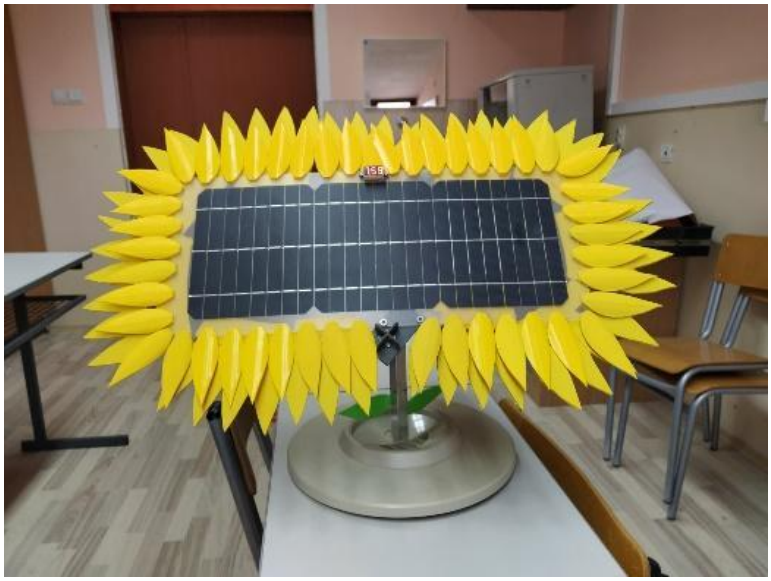
10. Evaluation/Assessment guidelines:

Evaluation is done through informal feedback from students and through formal assessment by the teacher

11. Lessons learned:

Students will be able to make their own mechatronic system that will monitor the position of the sun, produce electricity to charge the batteries of various devices

12. Additional information/Links:



13. Contact person:

Predrag Šubarević