

Introduction

We present to you a manual containing instructions for the preparation of experiments in physics that use new technologies. They are the result of the work of many students and teachers during the Erasmus+ project "Physics and new Technologies" Eupantec 2019. These materials are the result of cooperation between five European countries from the east, west, south and north. They are the result of exchanging experiences and learning together. In addition to the materials made available, the project also produced other materials that were used locally in each country in preparation for foreign mobilities. We had to make a choice due to the limited time allocated for training during the mobilities, we also verified the degree of difficulty of the developed experiment. It is worth mentioning here the project of building a thermal imaging camera, smog measurement system, water quality measurement, or experiments allowing the cooperation of the microcontroller and the Phyphox application. The construction of measuring systems also encouraged us to use 3D printing to develop housing for sensors and the Pico measuring interface. We will make the designs of 3D elements available on our website eupantec2019.eu, as well as MicroPython scripts.

We hope that our proposals will inspire teachers of physics, computer science and other subjects. Thanks to our study, lessons in physics or computer science can be more interesting. We know this because we have feedback not only from project participants, but also from students who used these materials during regular lessons. The published materials should be useful for conducting optional classes, developing skills in the field of science and computer science. We have such plans.

Personally, I have to say that before starting the project, I didn't think I would learn so much during the project. I think colleagues from other countries have similar feelings. New technologies force the updating of knowledge. While working on the project, we verified the usefulness of the tools we were supposed to use. I notice the great potential of the free Phyphox mobile application. A great discovery was the ease and effects of using MicroPython with the Raspberry Pi Pico microcontroller for € 5.-, which in many situations allows to successfully replace the laboratory equipment offered by world tycoons. Pico offers opportunities for cheap and effective

equipment for physical laboratories. This is not without significance for many European schools. Additionally, we can achieve better results, because the students have access to the code, understand the process of performing the measurement, they can adapt it to their own needs and create their own "firmware" of the measuring systems being built. Thanks to this, at the same time, along with physical knowledge, students improve their programming techniques.

Despite the very difficult conditions for the implementation of the project caused by the COVID-19 pandemic, most of the objectives have been achieved. For the participants, apart from building knowledge during the workshops, it was important to get to know colleagues from other countries and work together. The opportunity to get to know other countries and their culture was certainly of great importance. The practical use of foreign language skills was also very important. I am convinced that the positive experiences gained by students during the project may have an impact on the choice of fields of study related to physics and new technologies. We can already observe it.

We wish you pleasant reading and satisfaction with the results of the experiments described in this publication.

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