Science Club activity at Székely Mikó High School

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Abstract. The aim of the Science Club is to organize workshops that improve the students' technical and IT competencies. These transcurricular activities are based on STEM topics, Arduino applications, robotics and space research that are not taught at school curricula. Through these, the students will be acquainted with the latest results of science and technology and then apply them in practical workshops. Our achievements (Arduino controlled meteorological station, minisatellite, rescue and fire robot, etc.) show that these activities can motivate students to participate more effective at classroom activities, to learn theoretical subjects and then to choose a career in this field.

1 Arduino based applications

The students from the Science Club's robotics group have been working with Arduino and Redboard for 6 years. These microcontrollers are suitable for both simple and very complex applications: from flash switches to paper-piano, from line followers to fire robots. The younger students (12-14 years old) started their work with the learning phase. I explained the basic information-details about electrical circuits, microcontrollers (without internal structures description, semiconductors and microchip theory), sensors, communication between the sensors and the microcontroller, how the datasheets are used for each component to design a new measuring or dynamic device. The students from upper secondary school learned about the internal structure of Arduino board, communication protocol between microcontrollers, how the sensors work and how to develop the software for our robots. Arduino is an open-source electronics platform based on easy-to-use hardware and software, usable for interactive school projects. We mostly use Arduino Uno board (fig. 1), which is a microcontroller based on the atmega328 processor.

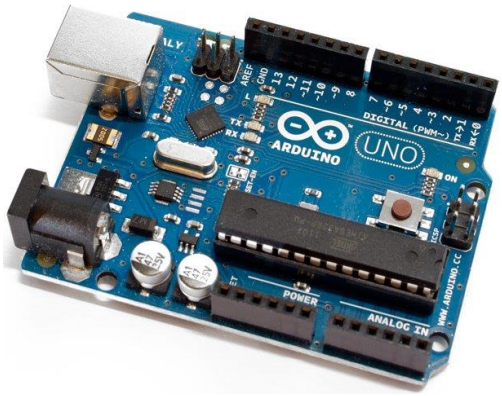

Fig. 1 The Arduino Uno board

The main task for the students is to build an autonomous robot, which is able to carry out a pre-programed mission without any human intervention (move or collect colored balls during the track, avoid obstacles, follow a track, move heavy objects, etc.) (fig.2)

Last year we built a mini meteo station (fig.3) which is fixed on the top of the gym and the central PC is located in the physics lab, they communicate wireless. The meteorological station sent humidity, pressure, temperature, solid pollution, UV index data for the ground station. We use this data for different classroom activity at Chemistry, Biology or Geography and school projects. These measurements helped the students understand easier the thermodynamic processes and atmosphere physics.

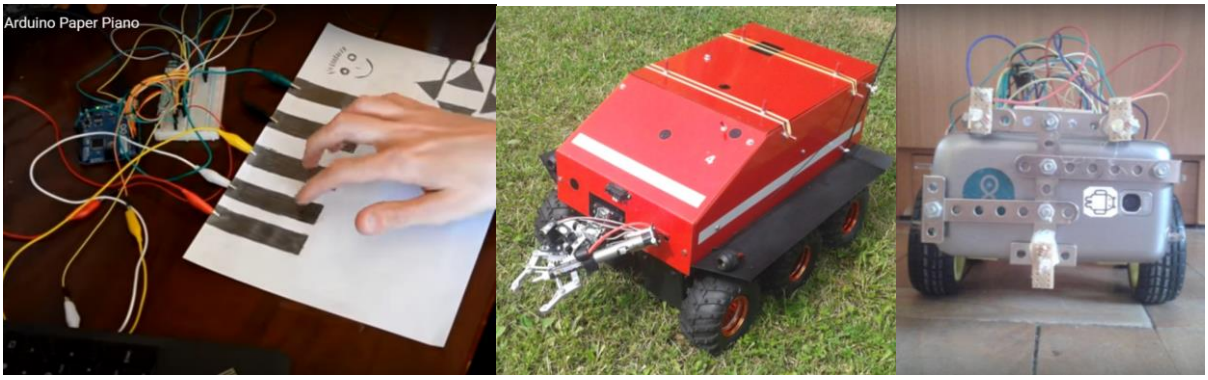

Fig. 2. Arduino controlled paper piano, Life-bot and 4WD android camera robot (made by G. Kovács, R. Krecht)

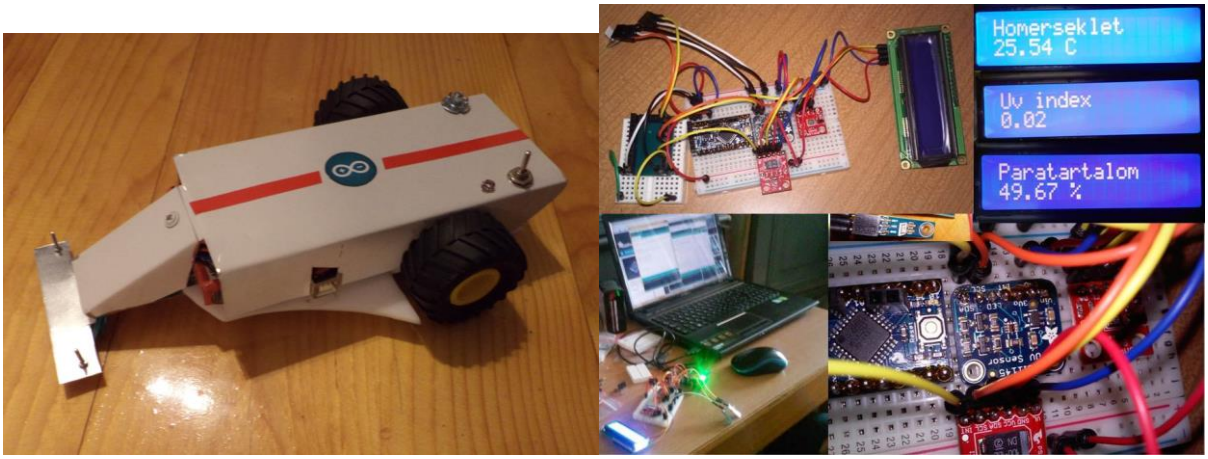

Fig.3. Arduino controlled line follower and mini meteorological station

2 Conclusion

This creative process performed with my students helps them deepen their understanding of the internal connection between the theory taught at physics and IT classes and those practical, technical applications. The students enjoy these classes because they participate actively and innovatively in every phase of the activities.

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References

[1] M.Pető, Robotics, Cansat, Arduino – physics at Székely Mikó Science Club; Teaching Physics Innovatively New Learning Environments and Methods in Physics Education, Proceedings of the international conference Teaching Physics Innovatively (TPI-15) New Learning Environments and Methods in Physics Education Budapest, editors: Király A., Tél T., 2015. (169-174).

[2] M. Pető, Experiments with Cansat-in ICPE-EPEC 2013 Conference Proceedings, The International Conference on Physics Education; Active learning - in a changing world of new technologies; Editors: L. Dvořák and V. Koudelková; Praga, 2014, ISBN 978-80-7378-266-5; (766.-774.);

[3] R. Petrianu, A. Velcu: Elemente practice de baza in dezvoltarea sistemelor cu micropocesoare integrate (Basic knowledge to developing microcontroller-based devices), Tehno Media, Sibiu, 2014.

[4] Curs Arduino si robotica (Arduino and robotic lessons for beginners), Robofun, Bucuresti, 2013.

[5] Raspberry PI pentru incepatori (Raspberry PI for beginners), Robofun, 2013.

[6] The CanSat book- ESA, NAROM (Norwegian Centre for Space-related Education)-