EDUTRONIX

Interactive Education Module for Mechatronics

Intelectual Output 05 – Preparation of the interactive module and the technical documentation for Edutronix Platform

Project information

Project acronym	EDUTRONIX
Project title	Edutronix - Interactive Education Module for Mechatronics
Programme	Erasmus+
Key Action 2	Cooperation for innovation and good practices, Strategic partnerships for education and vocational training
Project number	2015-1-PL01-KA202-016561
Beneficiary organisation	CKZ - Centrum Ksztalcenia Zawodowego w Wysokiem Mazowieckiem
Project web site	http://www.edutronix.eu
Report version	Part of Intelectual Output 05
Date of preparation	June 2017
Draft by	PP - Perfect Project LLC

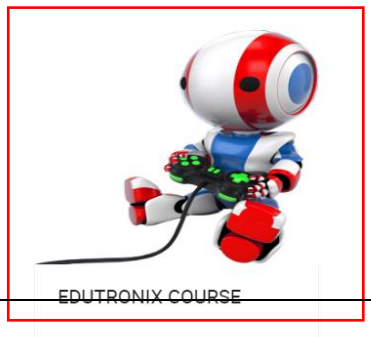
This project has been funded with support from the European Commisssion. This report reflects the view only from the author and the Commission cannot be held responsible for any use which may be made of the information contained herein.

The **Edutronix Platform** is divided in two parts:

- The **cover**, where we will find information about the Partners and the different Outputs.

Outputs

Project Information



Access to the Course

PARTNERS

(CKZ-PL) Centrum Kształcenia Zawodowego w Wysokiem Mazowieckiem

Centrum Kształcenia Zawodowego in Wysokie Mazowieckie is one of the most modern technical schools in northern part of the country. The school educates its students in many interesting and prospective departments on vocational and technical level, graduates gain not only necessary theoretical knowledge but also competences necessary for developing future careers. Although its history is not a very long one, as it dates back to 2002, the school can already boast about a range of achievements. It actively participates in various competitions, conducts charity events, organizes assemblies. In 2014 the school embarked on a new journey, Erasmus+ projects. Since then it has been successfully offering its students internships in countries like: Turkey, Portugal and Ireland. Another challenge taken up by the school authorities is Edutronix, a project designed to popularize and disseminate a branch of science, mechatronics.

The school offers modern, spacious and well equipped classes and laboratories. Students enjoy working with teachers, constantly upgrading their skills and the latest equipment meeting all the European standards.

Apart from focusing on technical peculiarities and solutions the school stands guards to tradition and moral values. It bears the honourable name of the Polish Home Army and pays attention to preserving its history and importance.

(AIJU-ES) Asociacion de Investigación de la Industria del Juguete, Conexas y Afines

AIJU research centre is a private, non-profit making organization aiming to boost research, development and technological innovation within toy and related industry, thus making it possible the achievement of a constant competitiveness increase in the sector. During 2014 the number of associated companies surpassed 500, most of them SMEs.

AIJU constantly adapts and evolves along with the industry of the region to provide them with timely and proper solutions. Therefore, AIJU does carry out a key role for the benefit of the regional industry since most companies are SMEs with limited possibilities to undertake the actions to achieve competitiveness and innovation by themselves.

AIJU capabilities are focused on toy and children's products industry and comprise disciplines such as materials and processes, rapid manufacturing and prototyping, logistics, environment, pedagogy/product, energy, social technology, innovation, management and toy safety regulations. In fact, AIJU was the first body recognized by the Spanish Government to carry out tests and laboratory reports according to the European Directive on safety of toys. Therefore, we support our associates through our four specific departments: Laboratory-Product Development Engineering, Management & Innovation, Pedagogy-Product and Training achieving a remarkable level of confidence and cooperation with our associates.

AIJU is a technology centre that is at the forefront of ICT technologies, with more than 70 professionals in our staff, AIJU has a multidisciplinary team that allows to cover projects from technological and social topics. It also provides a vision of the World of Work in educational projects, providing real case studies and adapted to reality.

Partners Information

ABOUT PROJECT

OBJECTIVES

The objective of the EDUTRONIX Project is to design, develop features, software and to create a ready-to-deploy and integrate into curriculum - the interactive educational module for technician of mechatronics during 24 months period.

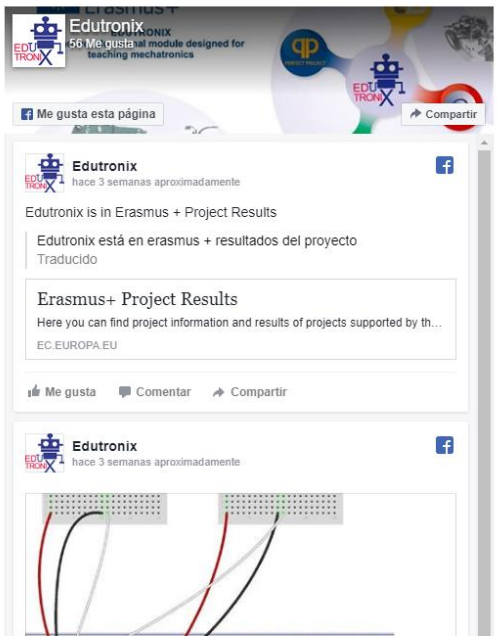
It introduces new methods and tools for vocational training, which enable active cooperation between teachers and students and also more effective and practical than conventional, as well as more expressive and efficient than traditional use of technology in teaching.

Project Objectives

EXPECTATIONS

The project is expected to:

1. Design a model for teaching mechatronics (the constant on-line access).
2. Develop model assumptions used for research in the field of mechatronics education.
3. Design a model utility for companies.
4. Software and model a set of assumptions for vocational education with use model.
5. Preparation of interactive module and technical documentation.
6. Innovative implementation of interactive program in mechatronics education using module.



Edutronix Facebook Page

Regarding Product development: we customized products by means of rapid prototyping and additive manufacturing technologies for disabled, high tech sport articles, etc., graphic and industrial design, electronic prototypes development, moulds adjusting/adapting & functionality providing, etc.

(CIS-IT) Scuola per la Gestione D'Impresa

CIS - Scuola per la gestione di impresa- is the training and consultancy company of Unindustria Reggio Emilia; the Association of entrepreneurs of Reggio Emilia.

With a staff of 27, CIS has been confirmed as the key training company of the Reggio Emilia industrial system, one of the more competitive industrial districts in Italy in terms of export, medium-high tech specialisation and R&D intensity. The district is specialised in mechatronics which is one of the 5 smart specialisation of Emilia Romagna regions.

The main goal of CIS is to contribute to the development of entrepreneurship, competitiveness and innovation of regional enterprises through ad-hoc consultancy and specialized (vocational and corporate) training services that meet business needs. CIS designs and develops both market financed training packages (vocational and corporate intensive courses) and funded projects under national or EU resources. One of its most successful training packages is "Master International Business studies", a market based graduate course which has reached its 18th year of activity and is aimed at graduates for a career in commercial and international business departments.

CIS, in close collaboration with the Association of entrepreneurs and the University of Modena and Reggio Emilia designs and manages vocational and corporate training courses, dissemination activities and workshops aimed at expanding R&D opportunities for SMEs especially in an interregional and cross-border perspective.

CIS cooperates with all the organizations located in the Reggio Emilia area (NUTS 3 province, about 500 thousands inhabitants) in particular with the education system (technical and non-technical high schools, University of Modena e Reggio Emilia) and the local innovation supporting actors (like Reggio Emilia Innovazione, the local innovation agency) to foster a unique strategy devoted to promote the local manufacturing base and its key strategic specialization of mechatronics.

(PP-PL) Perfect Project Spolka z ograniczona odpowiedzialnoscia

Perfect Project LLC is a training and research institution specialized in the field of education and training projects, both at a national and international level which employees have more than 11 years of experience in the field of higher education, vocational trainings, formal and non-formal education. Perfect Project LLC was created to support education especially through individually tailored ;trainings.

The three main pillars of the company's activities in this field are based on the fundamental aspects of education, namely:

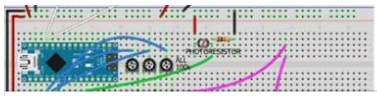
1. Adult education - by regular and on demand training courses.

2. Secondary education - by supporting vocational training centers and schools in the region.

3. Development of civic attitudes and social activities through information, transfer of knowledge and preparing entities and individuals to greater absorption of external funds for their development.

One of the major goals of Perfect Project LLC is to improve accessibility and quality of vocational and adult trainings, by specially designed methodologies, procedures and methods. We are capable to create tailor-made training for every participant.

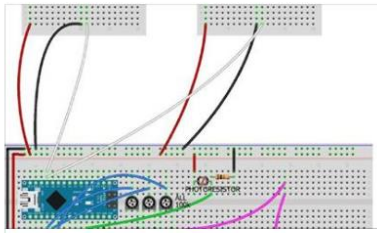
We also care about SMEs needs and their effective cooperation with education and higher education system with the positive effect on attractiveness of trainings at European level.



[PROJECT] Scary Eyes - Arduino controlled LED ...
#ShareTheScare this Halloween Visit our Halloween space and find out how...
ELEMENT14.COM

Me gusta Comentar Compartir

Edutronix
hace aproximadamente un mes



[PROJECT] Scary Eyes - Arduino controlled LED ...
#ShareTheScare this Halloween Visit our Halloween space and find out how...
ELEMENT14.COM

Me gusta Comentar Compartir

Álbum International Conference Edutronix Project.

Edutronix
hace aproximadamente 2 meses

Multiplier Event held in Poland, 20-September-2017

10 Comentar 1

Edutronix
hace aproximadamente 2 meses

All is ready for the International Conference of the Edutronix Project

Todo está listo para la conferencia internacional del proyecto edutronix
Traducido

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NEWS →

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Szkolenie Hiszpania

Szkolenie Wéochy

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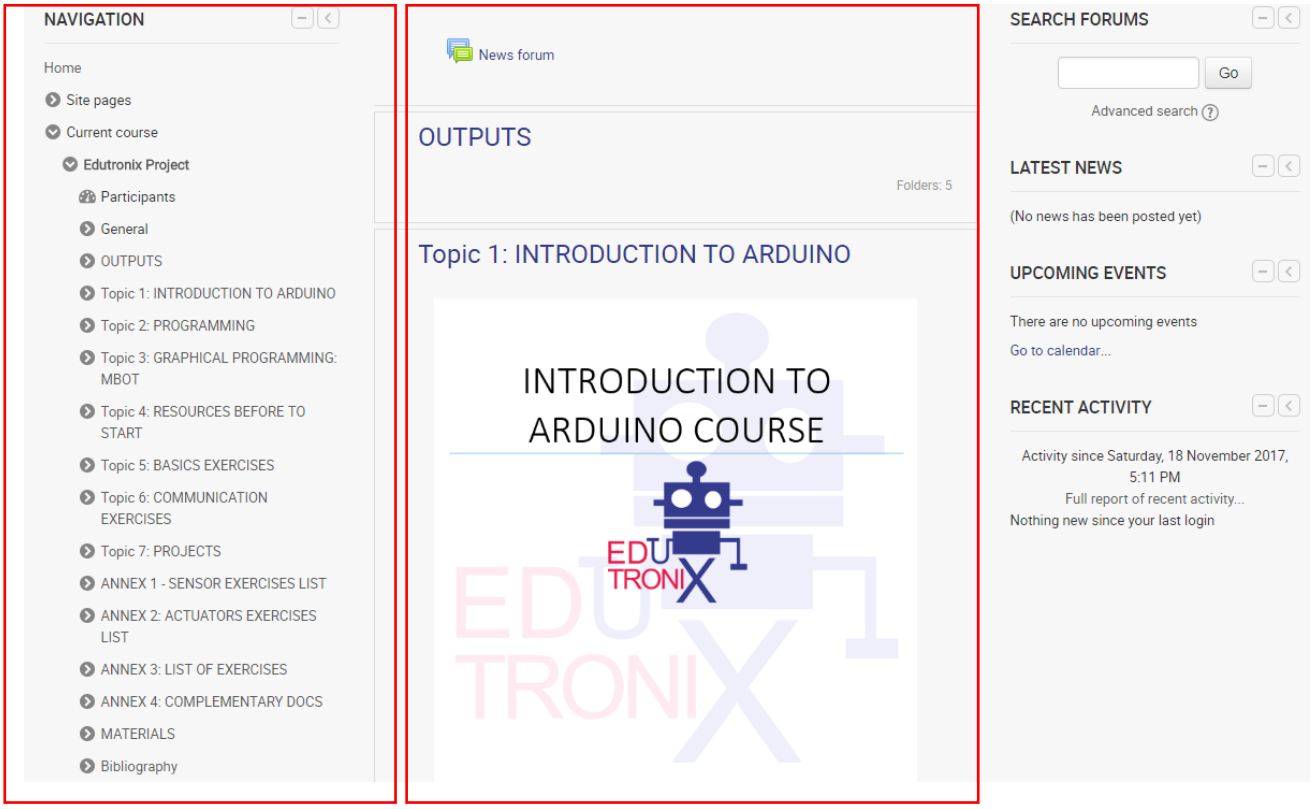
Co-funded by the Erasmus+ Programme of the European Union

- The **course**, where we can train in the field of mechatronics:



Navigation Menu

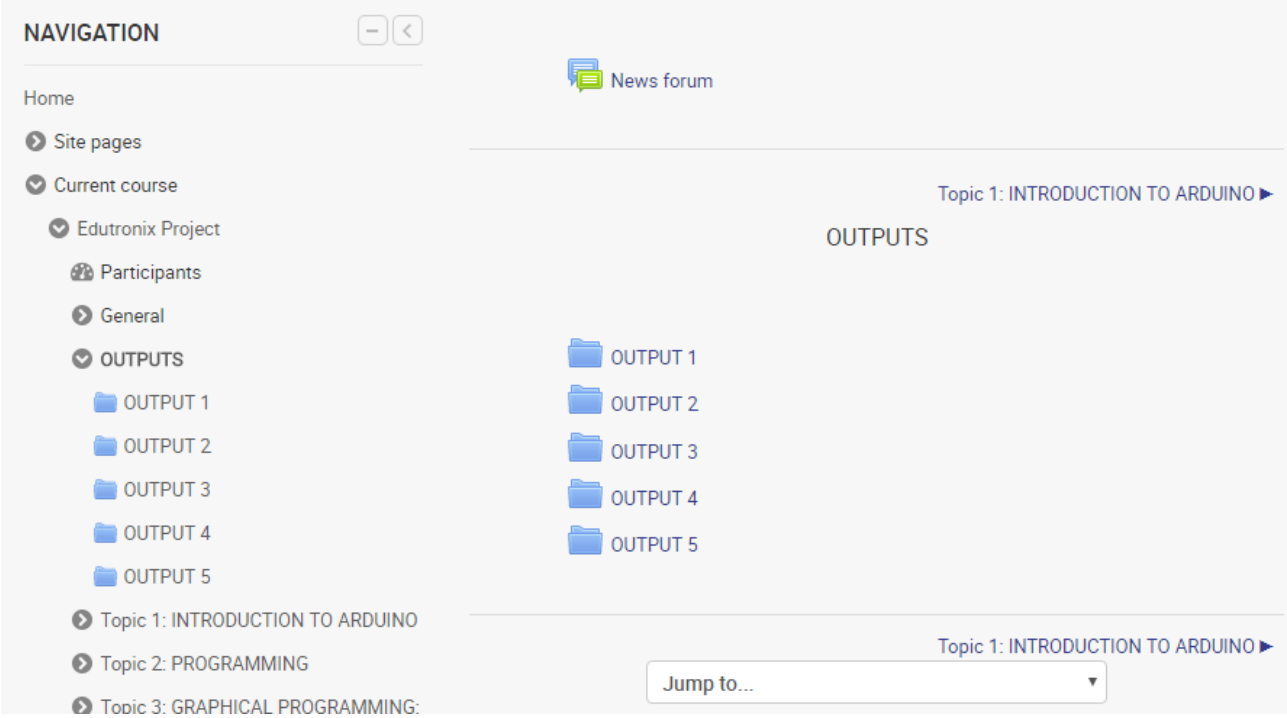
Course Content

In the course we can find:

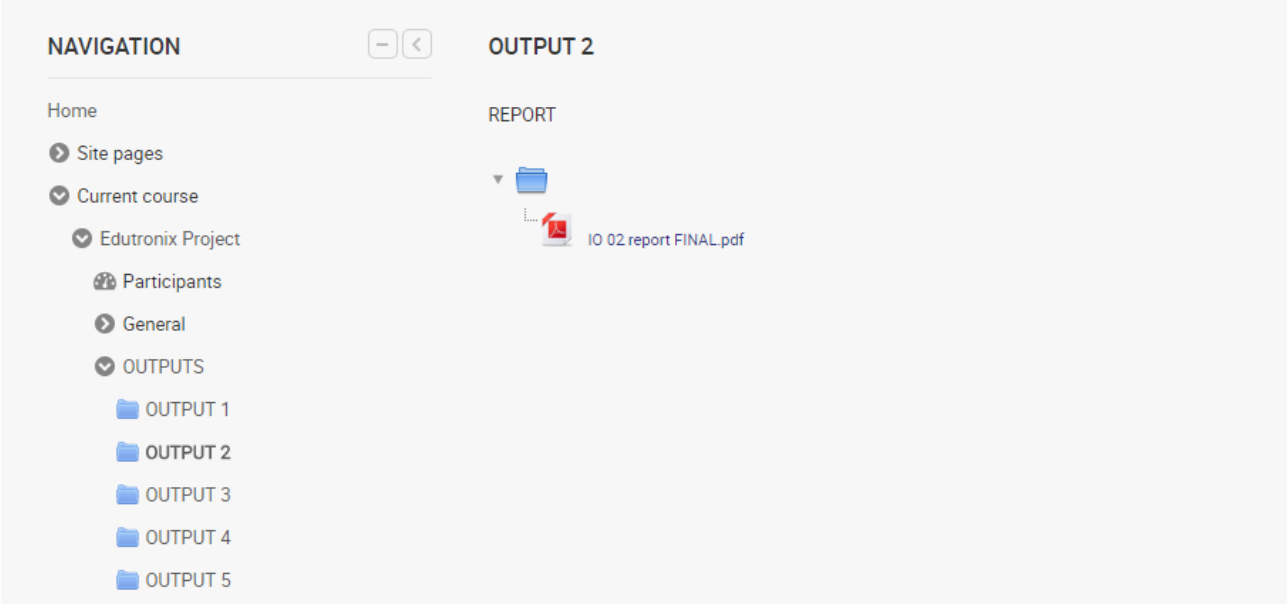
- ❖ All the **Ouputs** of the project.
- ❖ 7 **Topics** with the **mechatronics training**.
- ❖ 4 **Annexs with** different **Exercises**.
- ❖ A **Material List**.
- ❖ A **Bibliography**.

Below is a detailed description of each section of the course.

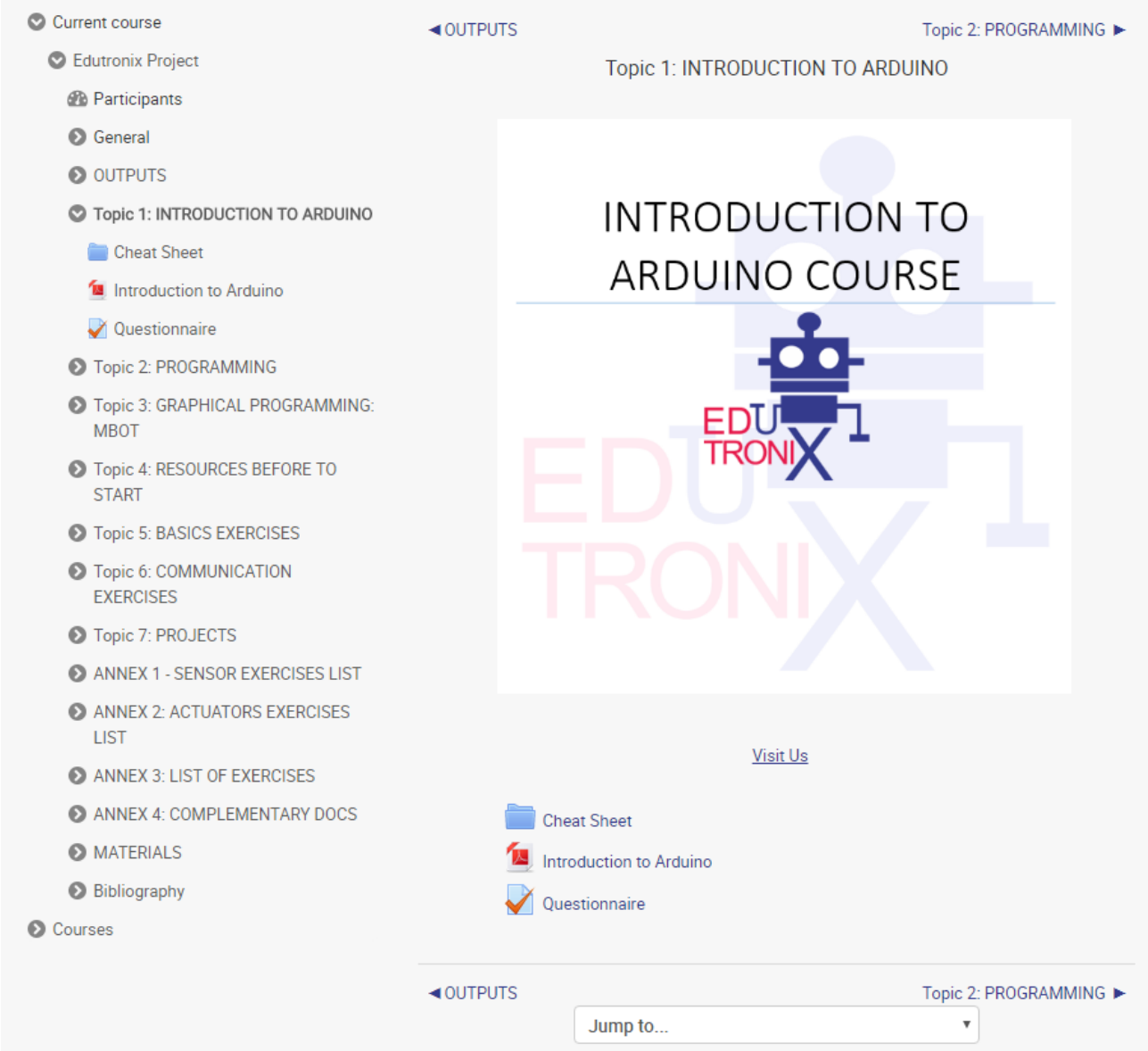
- **Outputs**:
  - You can find the all outputs of project.



For example, Output 2 view

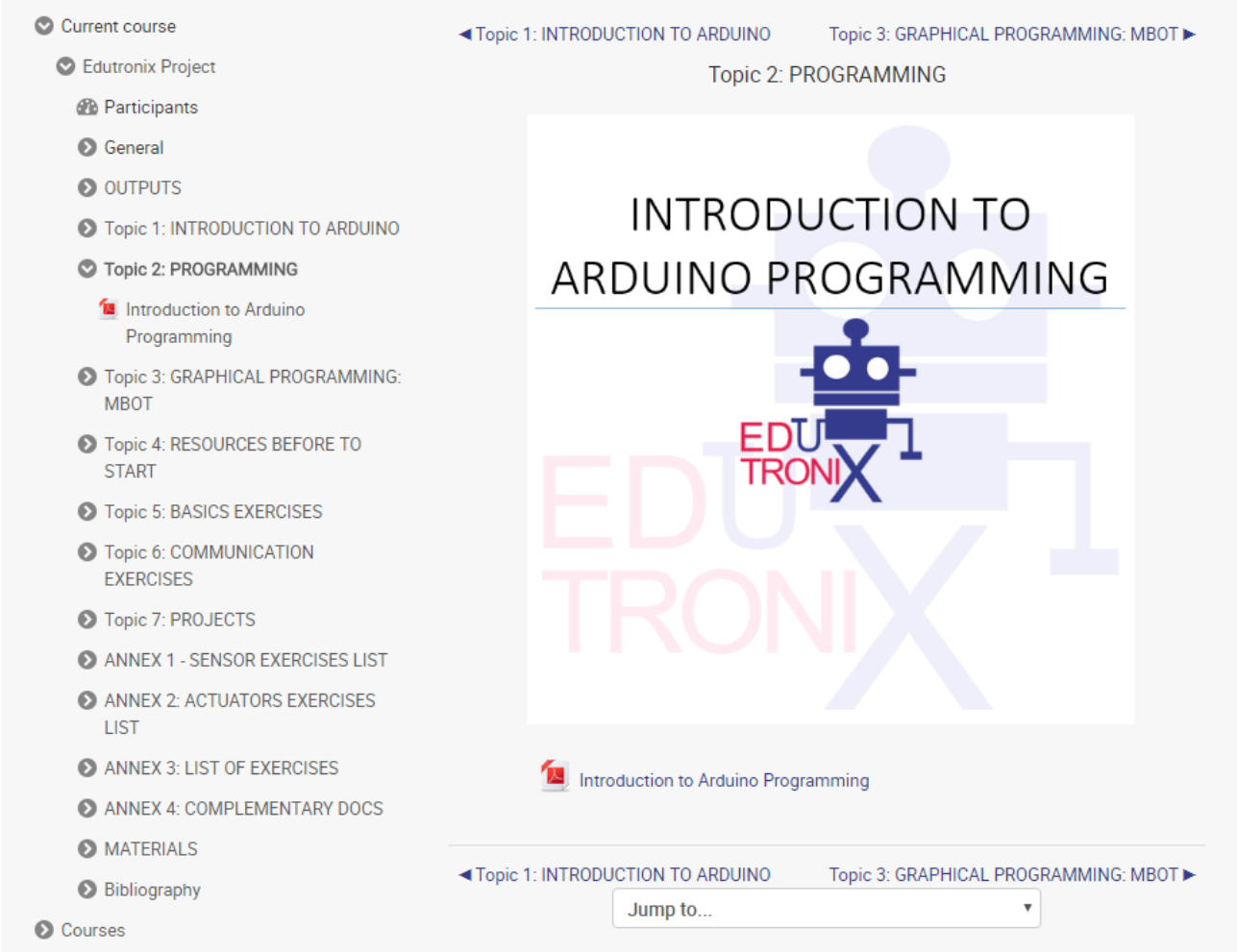


➢ Topic 1 - **Introduction to Arduino**:



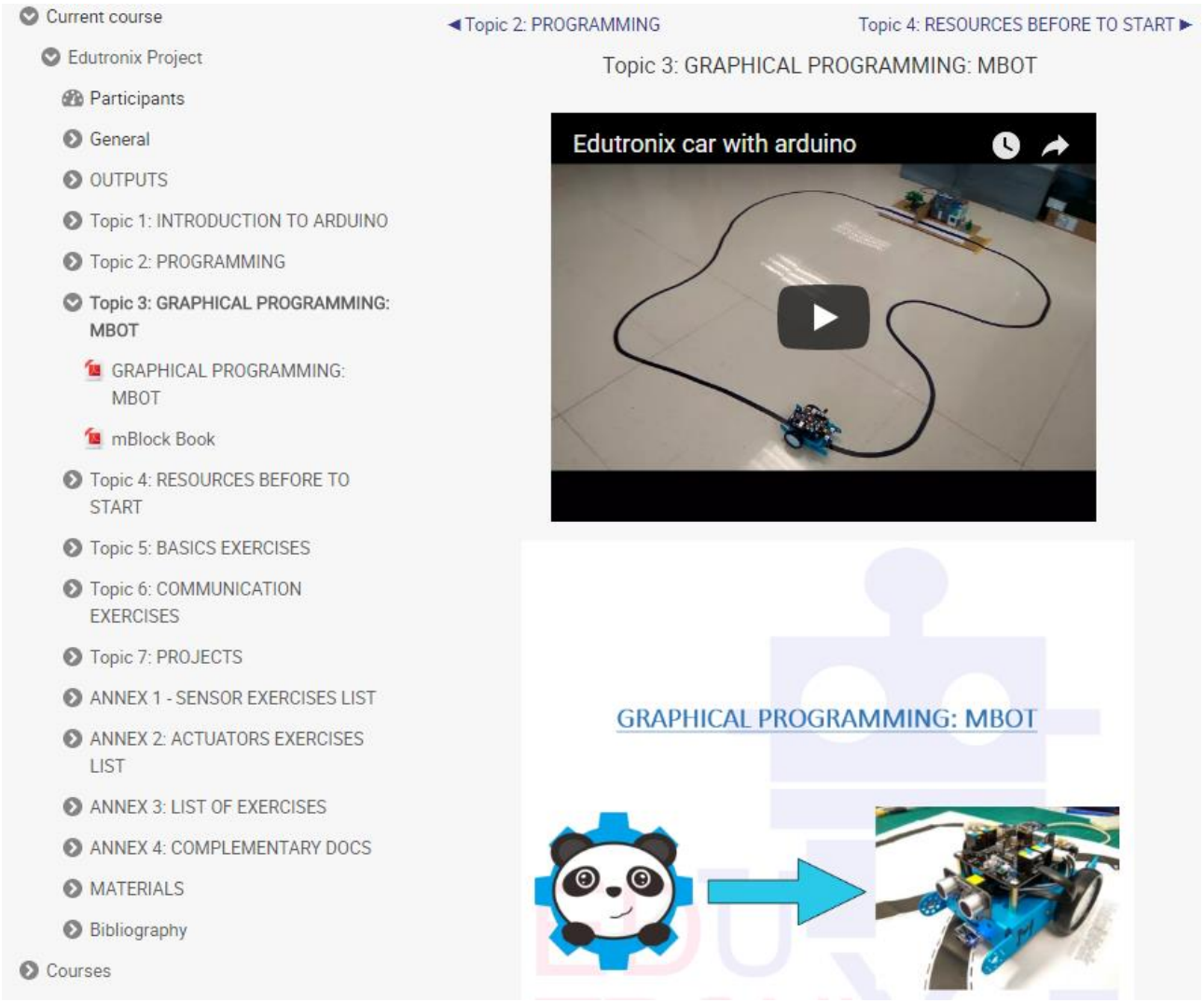
- In this topic you have:
  - An "**Introduction to Arduino Course**" PDF.
  - A **Cheat Sheet** PDF.
  - A **Questionnaire** of the previous PDFs.

➢ Topic 2 - **Programming**:



- In this topic you have:
  - An "**Introduction to Arduino Programming**" PDF.

- Topic 3 - **Graphical Programming**:



GRAPHICAL PROGRAMMING: MBOT

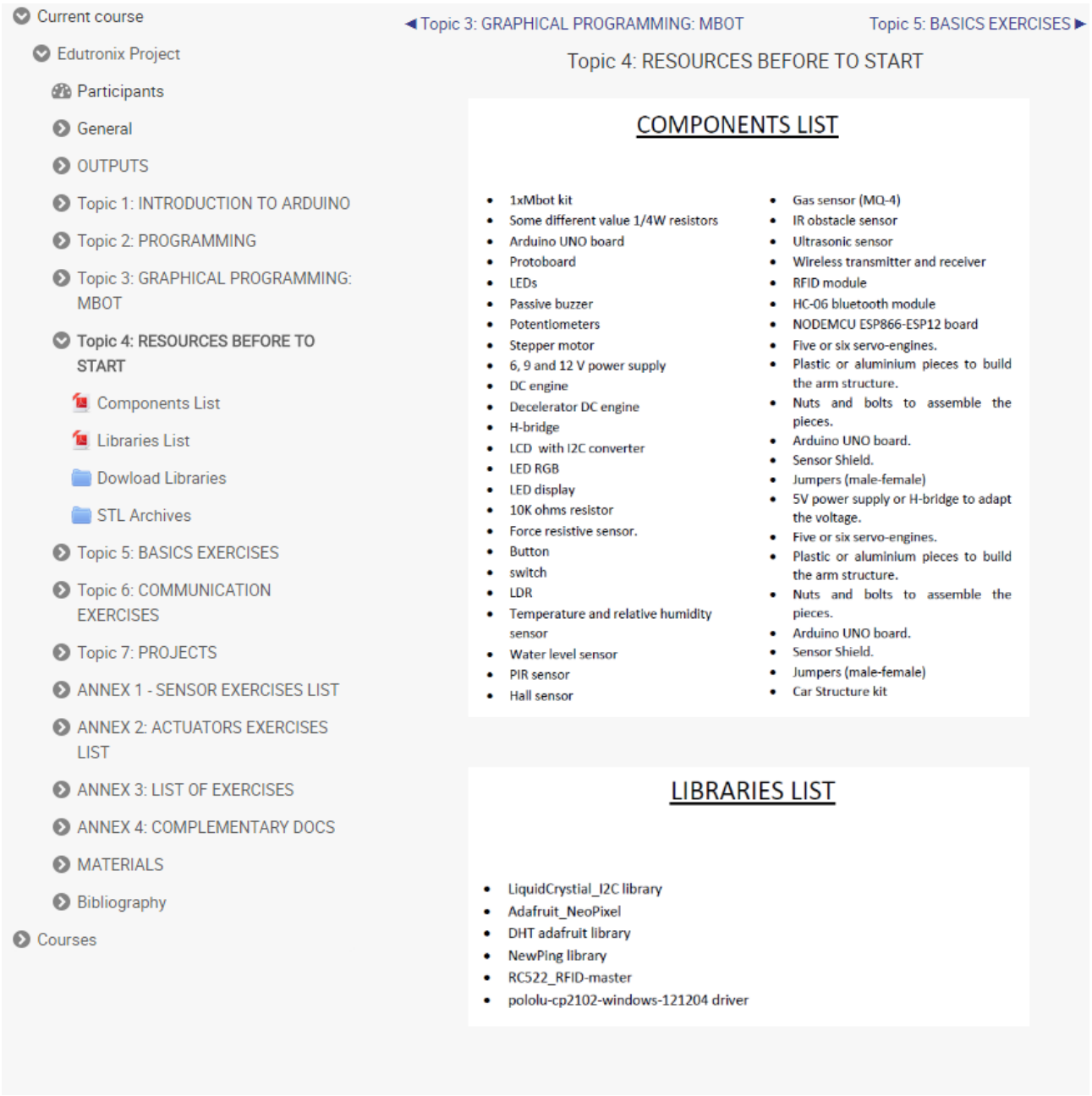
mBlock Book

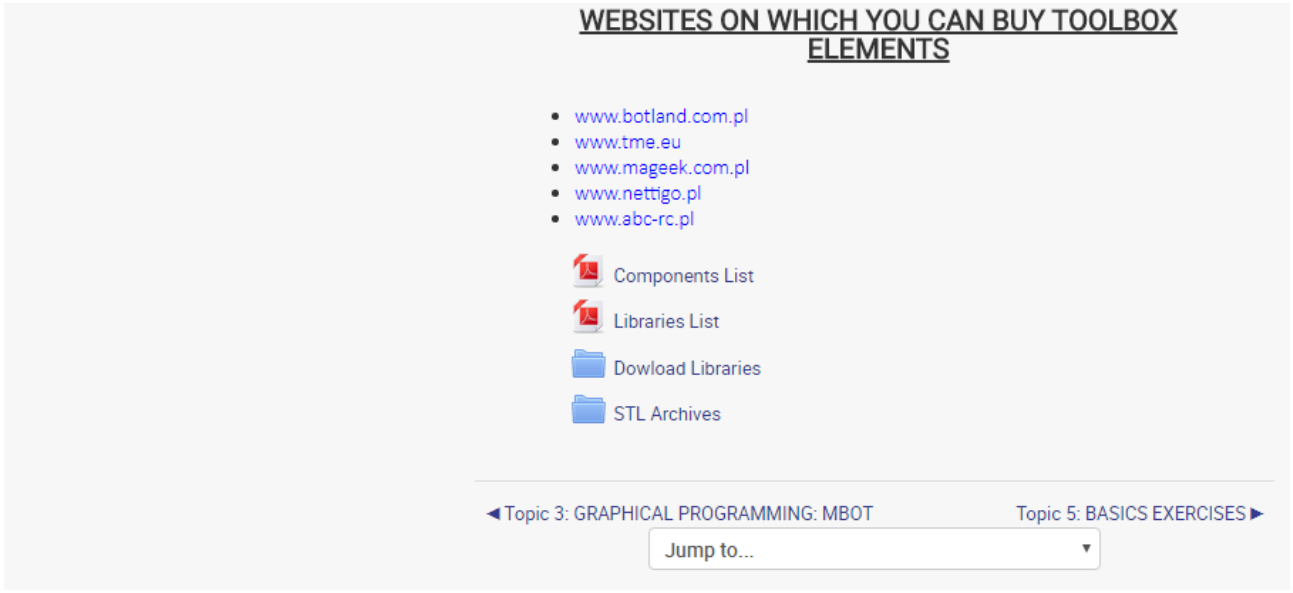
◄ Topic 2: PROGRAMMING Topic 4: RESOURCES BEFORE TO START ►

Jump to...

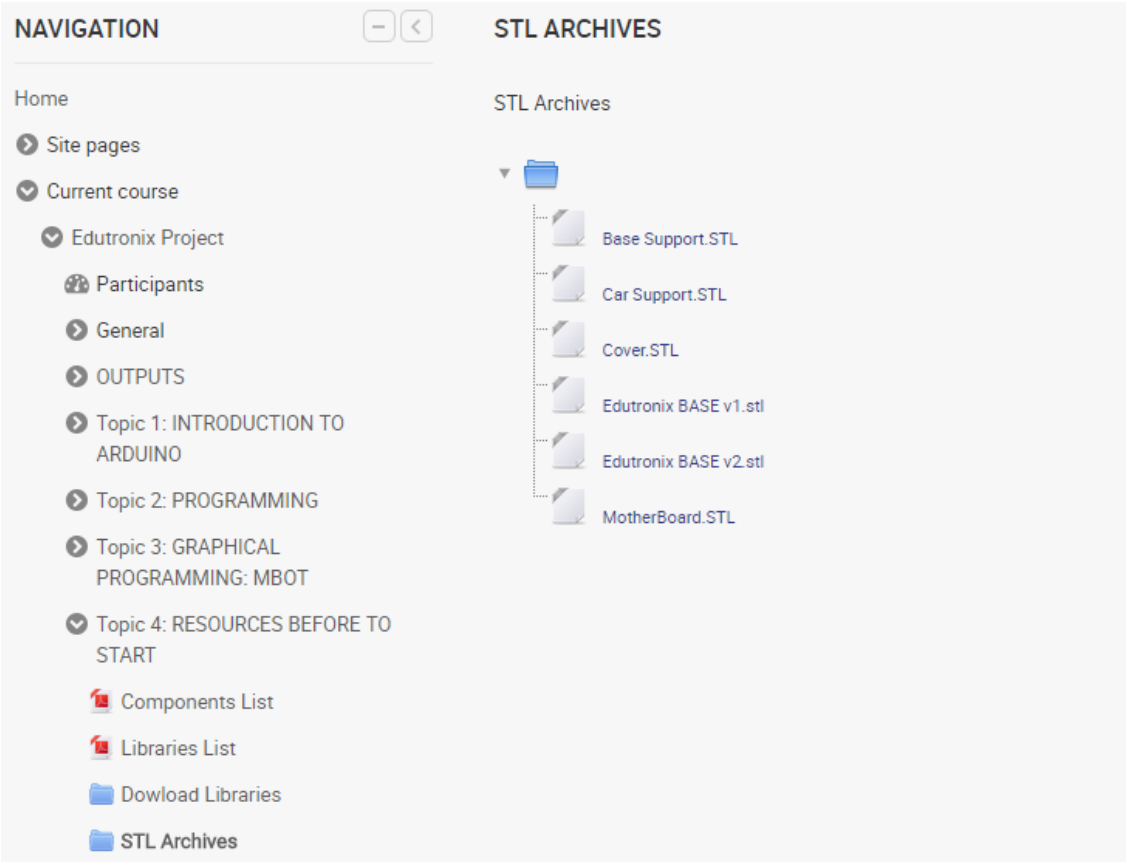
- In this topic you have:
  - A demonstration **video**.
  - A **"Graphical Programming MBOT"** PDF.
  - An introduction to **mBlock**, for **programming mBot** PDF.

➢ Topic 4 - **Resources before to Start**:

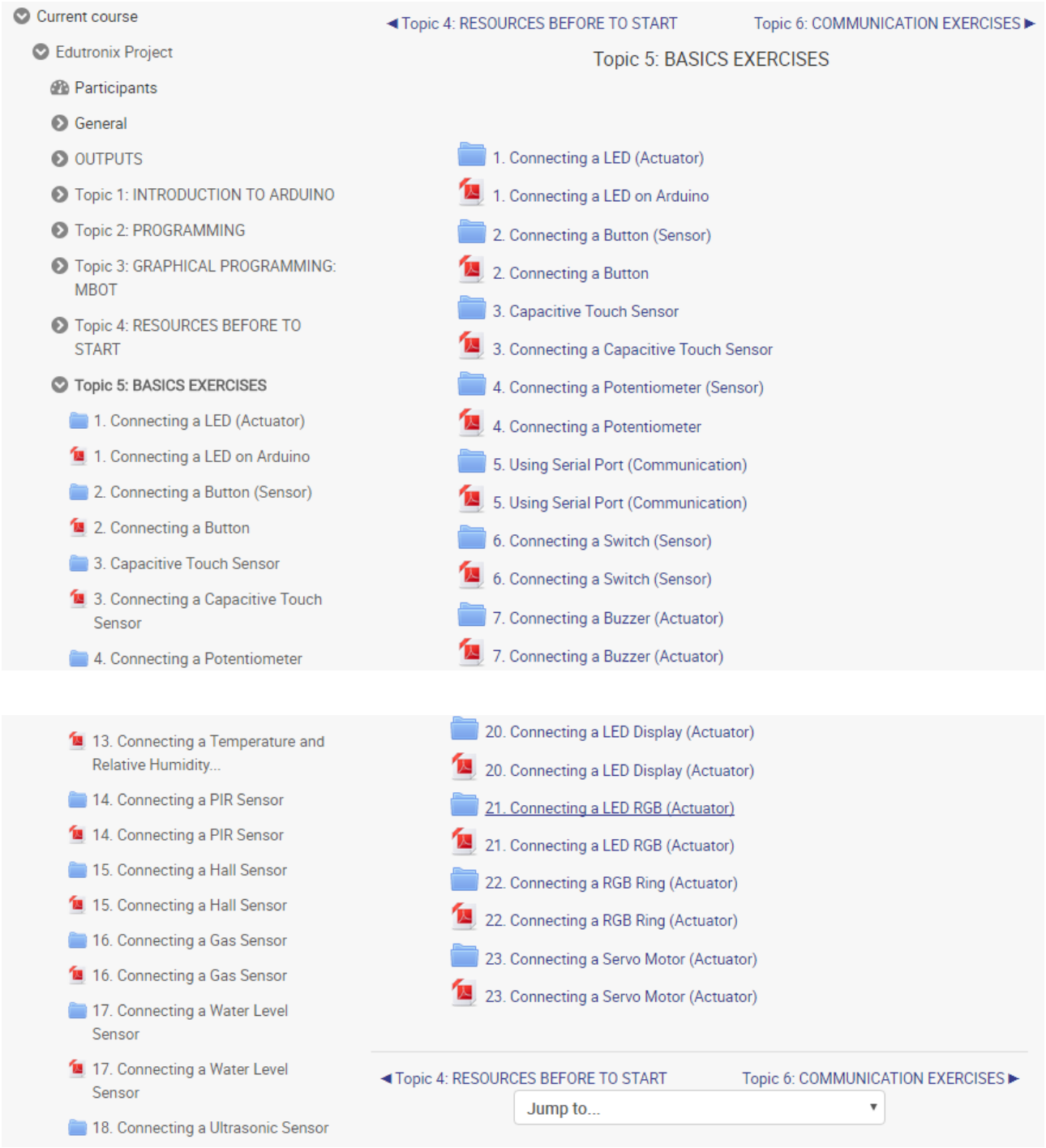




- In this topic you have:
  - A "**Components List**" PDF.
  - A **"Libraries List"** PDF.
  - Some **Libraries** for download.
  - Some **links** of websites where **buy toolbox elements**.
  - **STL Archives**.

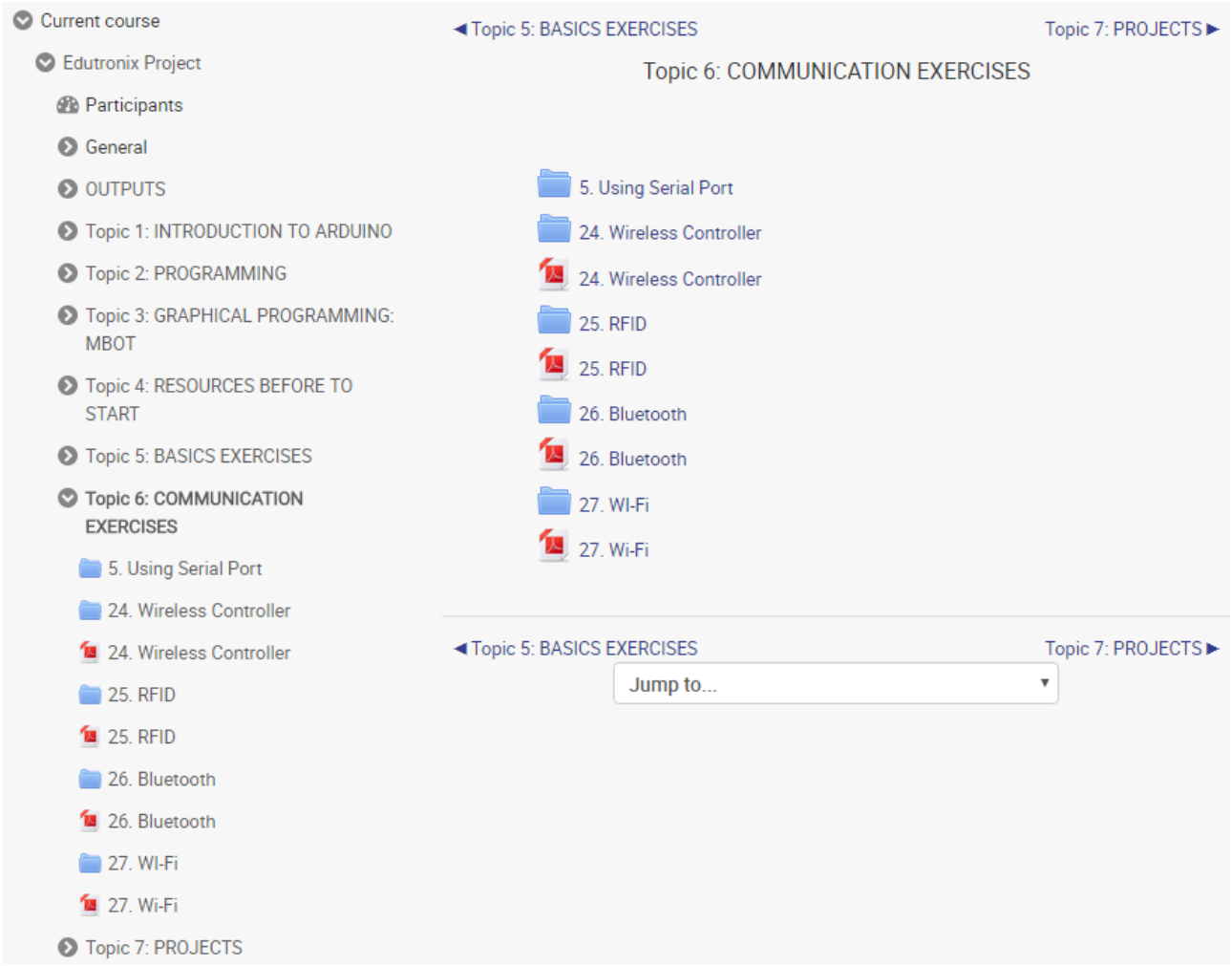


➢ Topic 5 - **Basics Exercises**:

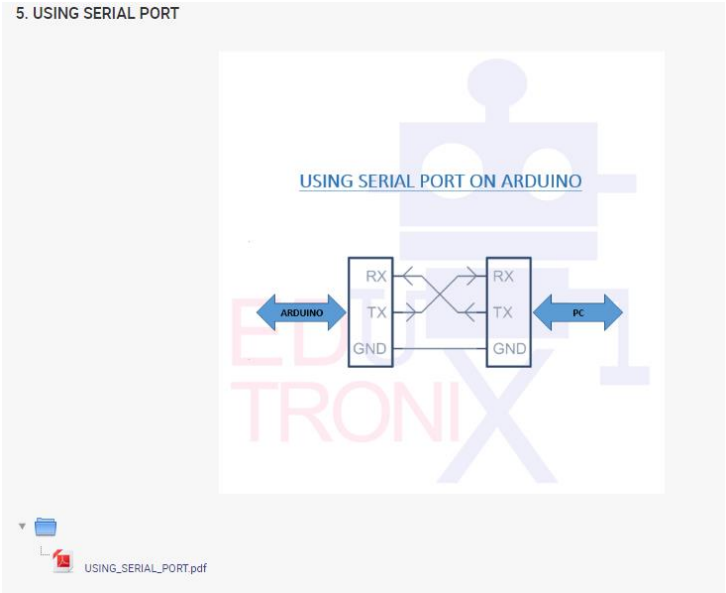


- In this topic you have:
  - Different **examples** of **connect sensors** and **actuators** to **Arduino**.

➢ Topic 6 - **Communication Exercises**:



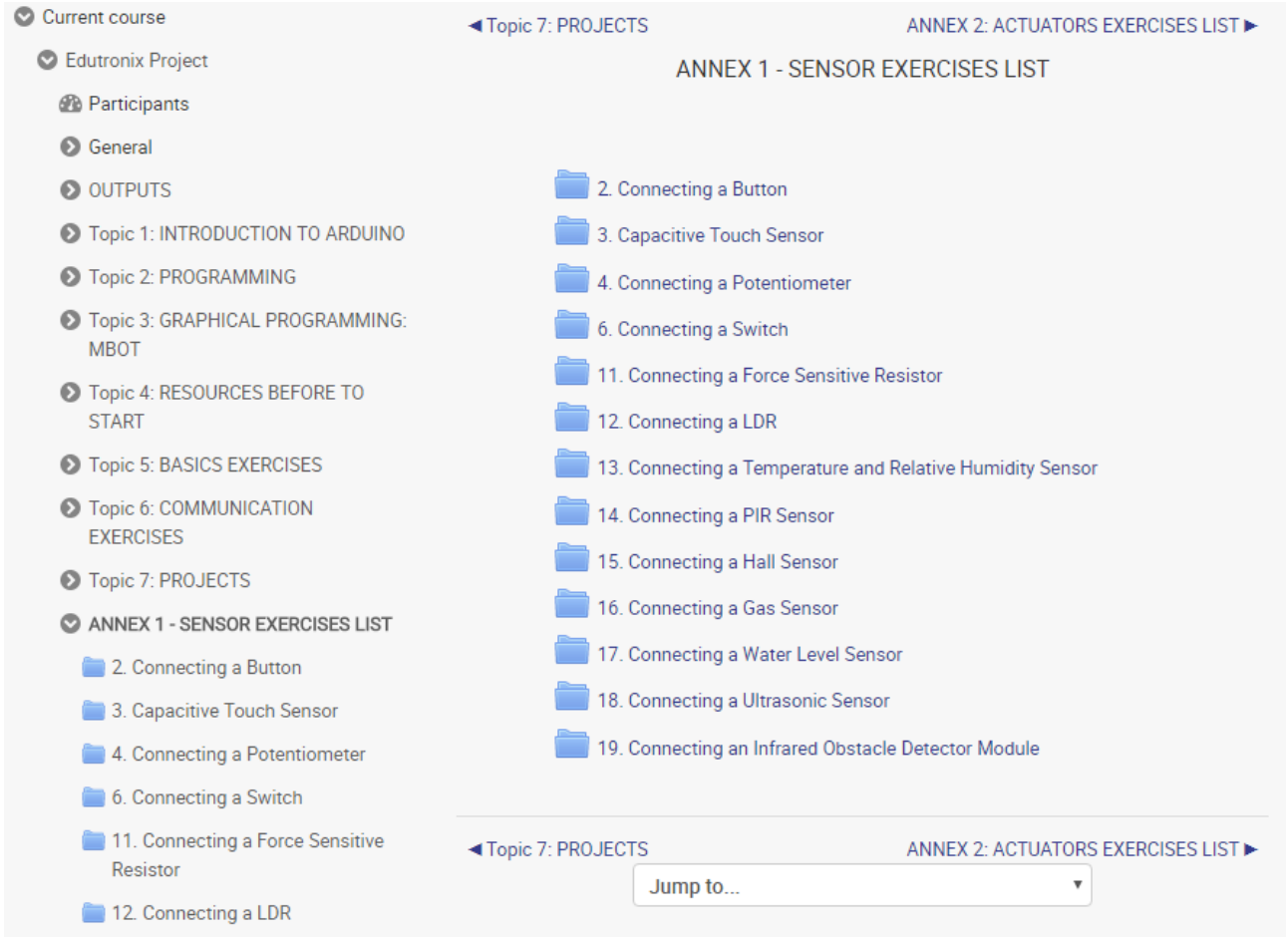
- In this topic you have:
  - Different examples of **communication** with Arduino.



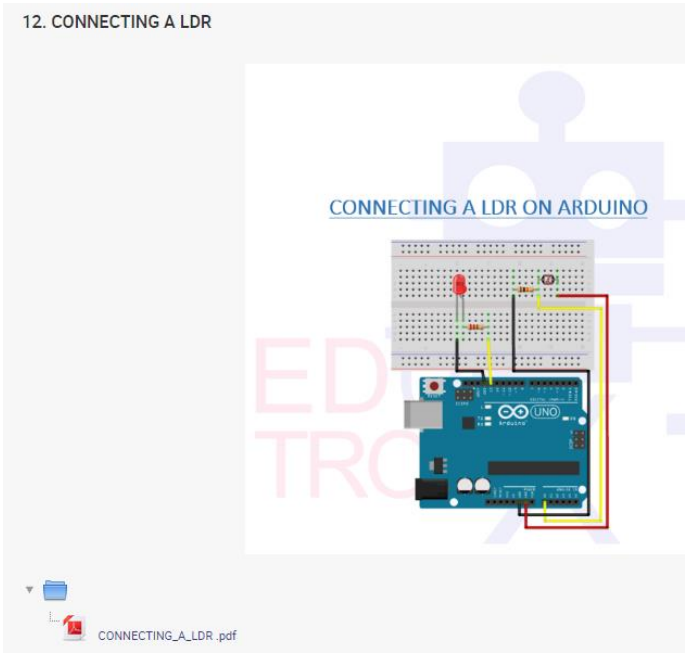
➢ Topic 7 - **Projects**:

- In this topic you have:
  - Some **projects** examples in **Arduino**.

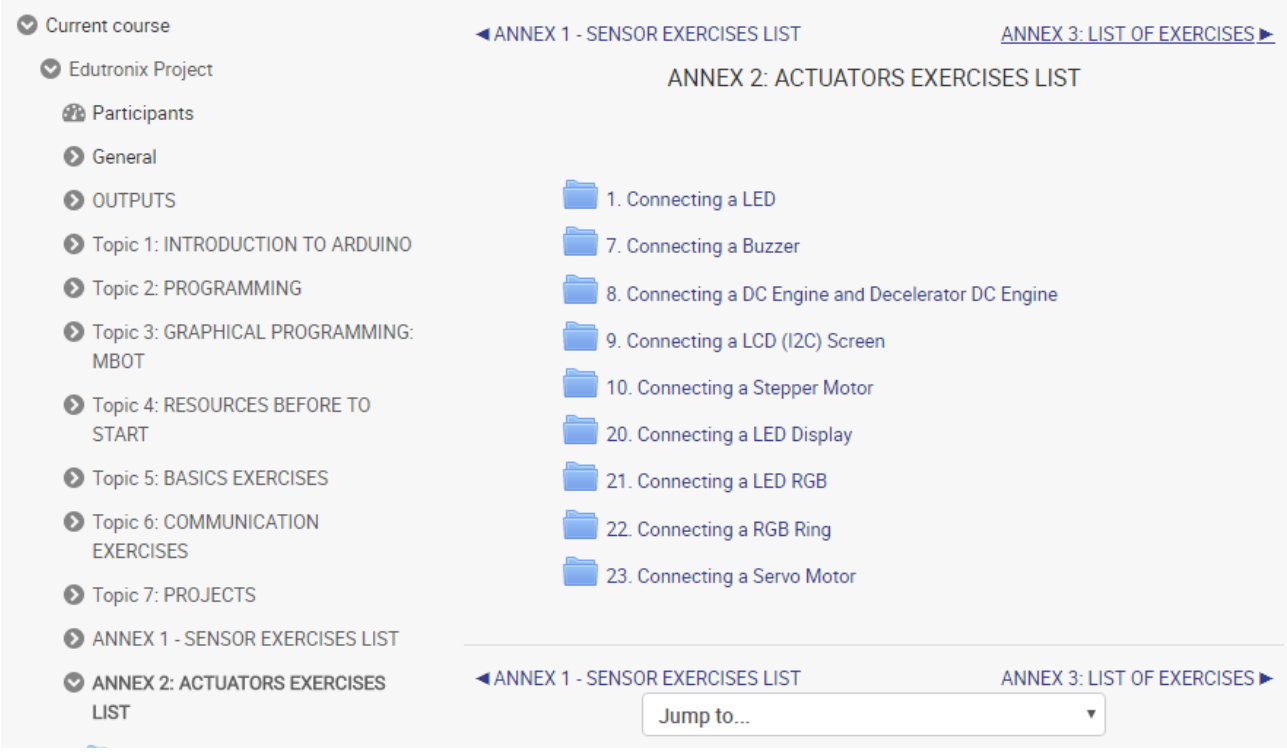
➢ Annex 1 - **Sensors Exercises List**:



- In this topic you have:
  - **Sensors Exercises**.

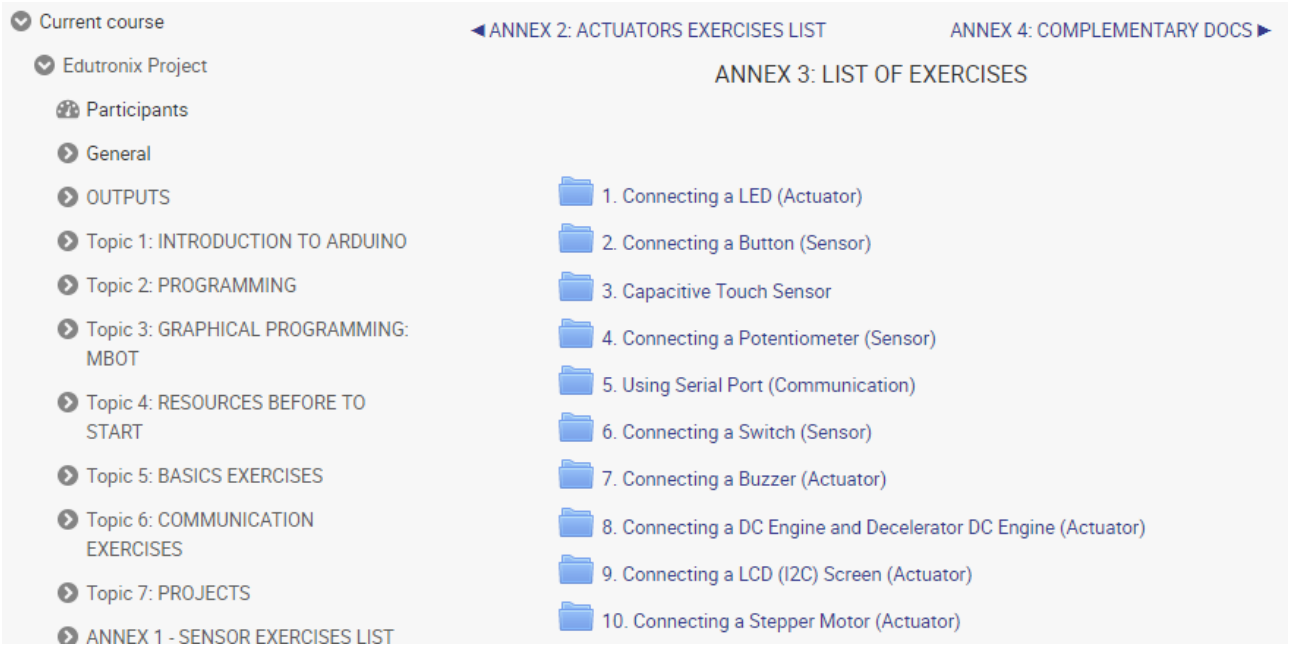


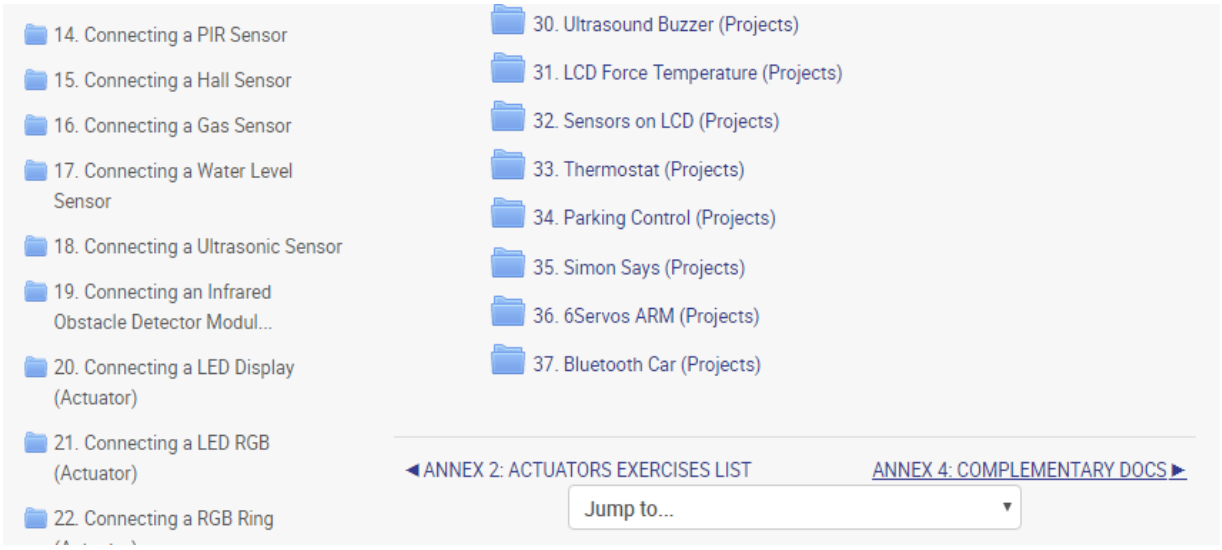
- Annex 2 - **Actuators Exercises List**:



- In this topic you have:
  - **Actuators Exercises**.

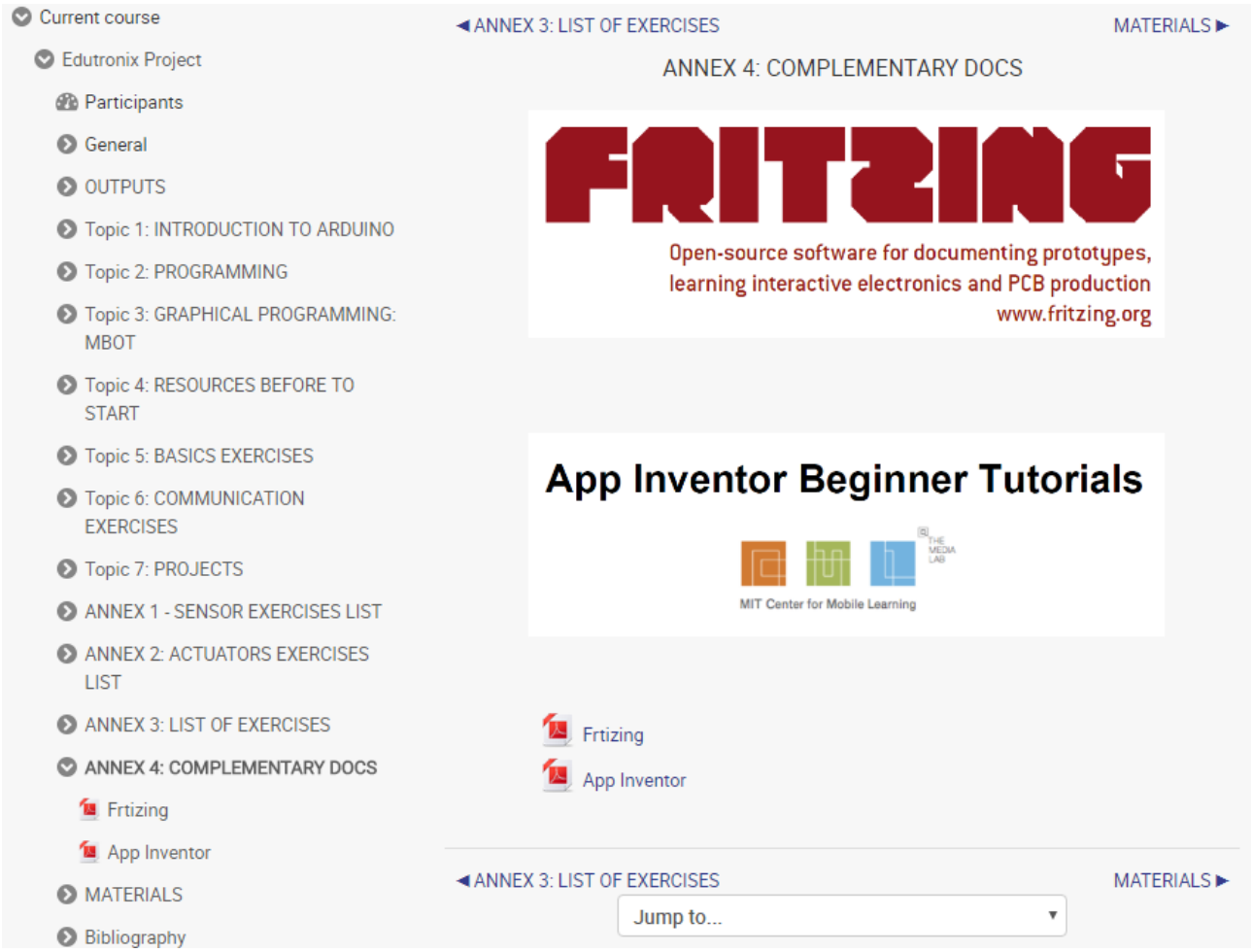
➢ Annex 3 - **List of Exercises**:





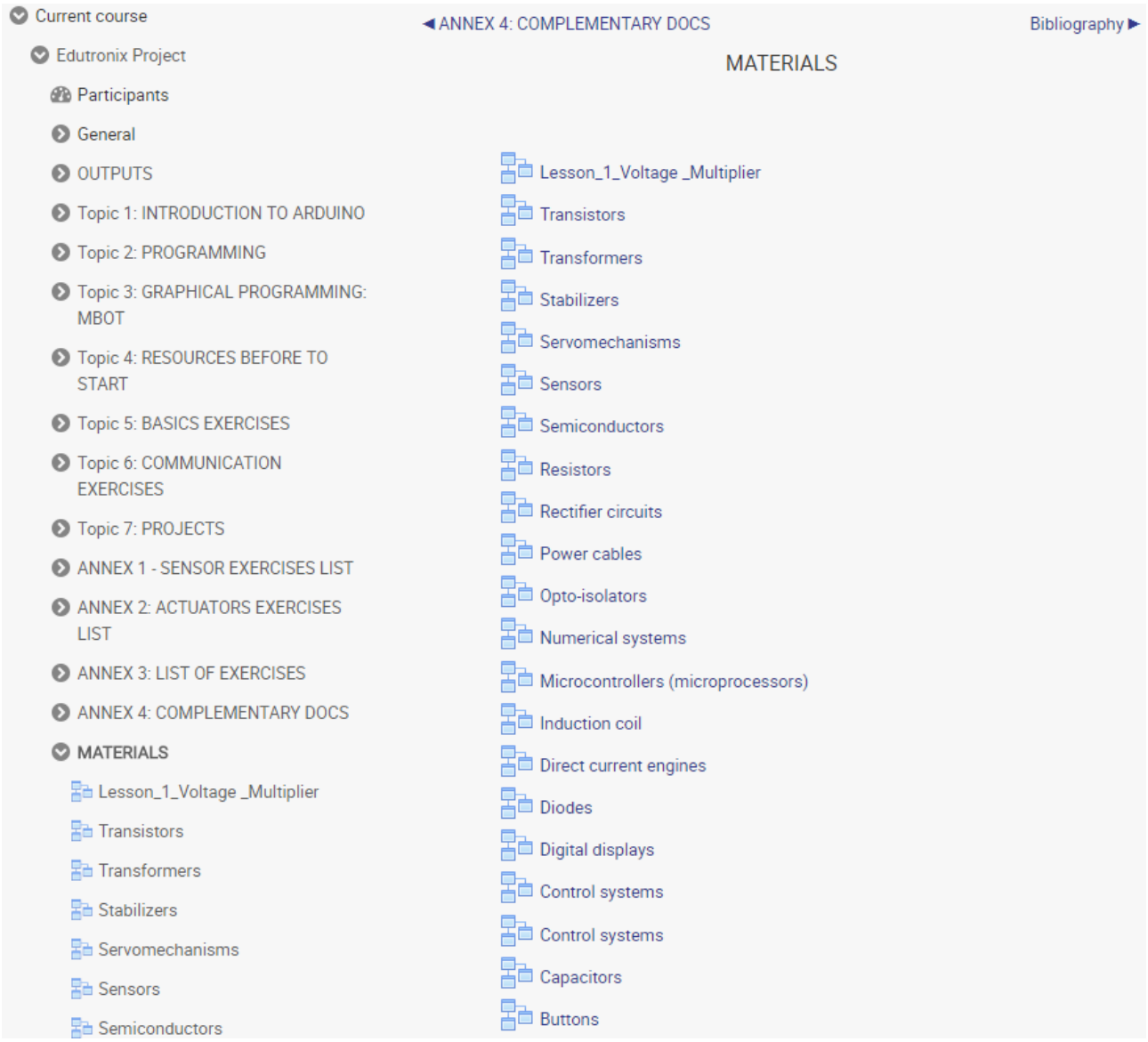
- In this topic you have:
  - **All** the exercises.

➢ Annex 4 - **Complementary Docs**:



- In this topic you have:
  - "**Fritzing**" PDF, an open source software for documenting prototypes and learning electronics.
  - "**APP Inventor**" PDF, a software for develop applications that will connect with Arduino.

- **Materials:**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Edutronix Project
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General
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Topic 2: PROGRAMMING
Topic 3: GRAPHICAL PROGRAMMING: MBOT
Topic 4: RESOURCES BEFORE TO START
Topic 5: BASICS EXERCISES
Topic 6: COMMUNICATION EXERCISES
Topic 7: PROJECTS
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ANNEX 2: ACTUATORS EXERCISES LIST
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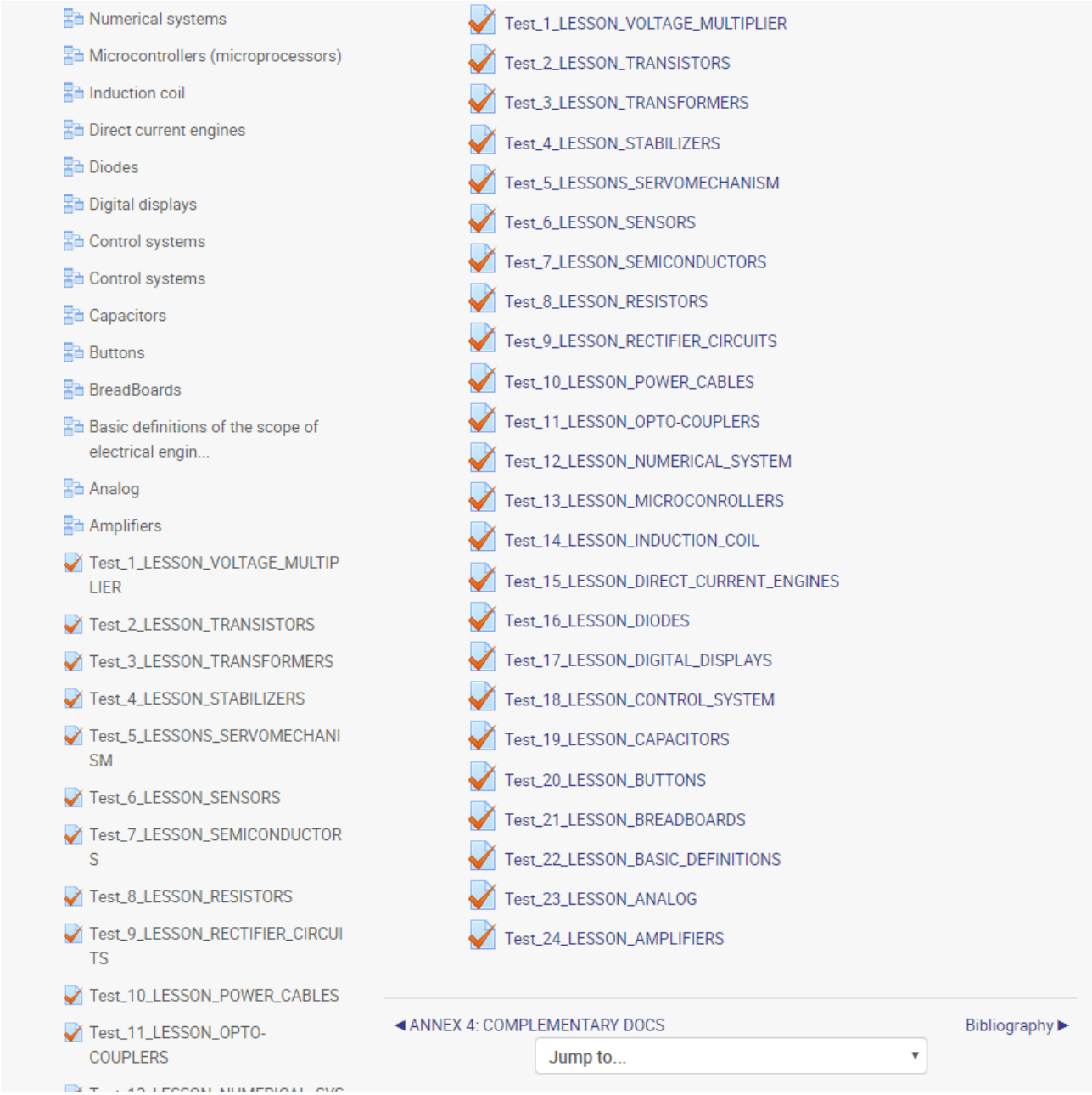
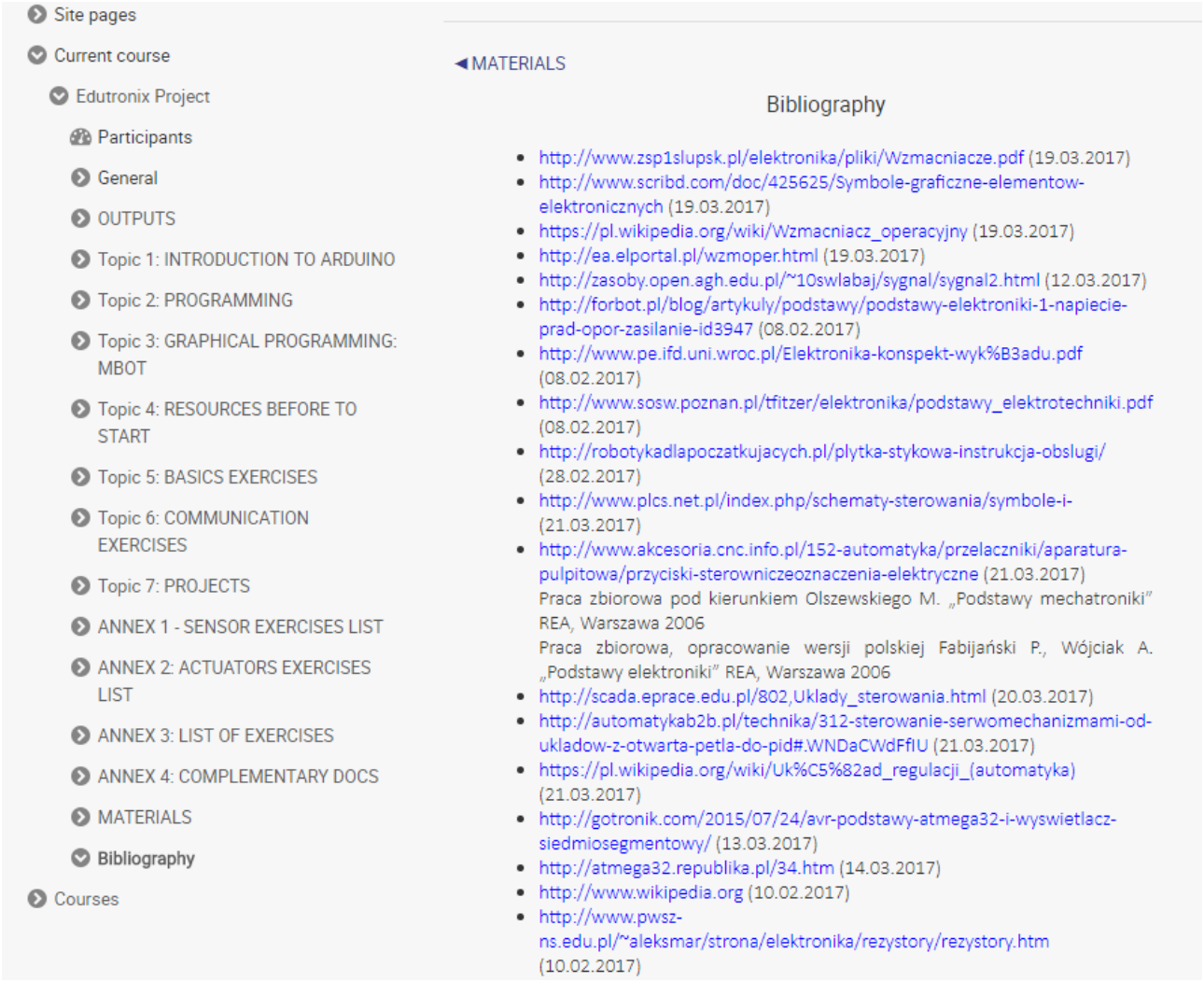
Microcontrollers (microprocessors)
Induction coil
Direct current engines
Diodes
Digital displays
Control systems
Control systems
Capacitors
Buttons



- In this topic you have:
  - All the **materials** for advanced in the course.
  - All the **tests** for verify that you are learning.

➢ **Bibliography**:



- In this topic you have:
  - All the **bibliography** of which the course has been composed.

For the reader benefit and ease of further use of the platform, we anticipate the contents of the whole interactive Edutronix platform below:

GENERAL SECTION

Sharing the news on the platform forum for all the parties (users, creators, teachers, students, entrepreneurs) taking part in the processes of development and creation of this initiative joins their ideas and gives a possibility to discuss and give recommendations for improving the further use of the Edutronix platform.

The news forum provides “idea sharing” possibilities for all the users and supporters from across Europe and gives the opportunity to deepen their conversation and, together, wrestle with the tough issues affecting mechatronics learners and giving them more chances for success.

The forum provides the chance for all interested users to start small-group discussions, participants to explore and share ideas from all around platform, and provide users with additional resources and support to carry out extra exercises for their development. The conversations will also give everyone the chance to grapple with the difficult implications of such idea as teaching mechatronics using the Edutronix platform.

Forum builds on the work of all project consortium organizations in the field of teaching mechatronics to bring people together in dialogues, exploring ways to help users using the platform. The issues such as school readiness, linked systems for education, entrepreneurs context, access for users (students/teachers) to development and training for employment, and educational opportunities might be discussed just there.

Following the forum possibilities, the groups might create a platform for dialogue of participants to share ideas for creating brighter futures for teaching even more difficult mechatronic issues via such a platforms in the future.

OUTPUTS SECTION

Presentation of all the intellectual outputs of the project in its final shape in one place is crucial because of many factors. First of all the users will not need to search it all over platform. The next reason is that it will be much more convenient to use all the outputs for further use by interested parties (schools, institutions, companies) from outside the project consortium for their own purposes. And the last but not least it will create a brief but comprehensive database and roadmap for all the stakeholders on how we did that and what was all the reasons we did it just the way it is done. Overall there are 6 Intelectual Outputs in the project. Description of what we needed to create in every single one of them is a part of the project which refers to the timeline and the responsible institution(s).

In **Output 1** - The project of model for teaching mechatronics (with on-line access). The aim was to be able to create an interactive educational module, at the outset we must therefore design a project model of such “thing”. So we needed to define and identify the needs of the participants of vocational training (future mechatronics) and partner organizations, their suggestions and the actual needs of the labor market. We did it by:

1. Modeling the system using different methods to determine the most effective solution;

2. Use of physical modeling languages, graphs bonds, etc.;

3. Use of the hardware description language;

4. Use of simulations available for modeling and simulation of selected mechatronic systems.

Output shows how to integrate classical mechanical devices with microprocessor controls and how to apply them in the learning processes by the designed model. As part of the result we also determine, explore and develop project of integrated mechanical and electronic system that demonstrate a certain degree of "intelligence" on the basis of interaction, consisting mainly in the decision-making autonomy and ability to assess student skills. The system is designed as such to be able by the sensors to receive signals from their environment, process them using a microprocessor and respond by using actors according to the situation.

The project developed by this intellectual output involve actions in several dimensions, which were developed in the next results of intellectual work:

1. design of mechanical assemblies;

2. design of electronics system with signal processing;

3. design of the associated software components and software engineering focused on the development of algorithms for processing data.

The task was done it three typical phases: mechanical design, electronic control and software development. For so designed module construction “the module” is flexible and can be used in a variety of tasks.

Output 2 - Development of model assumptions to be used for education purpose. The result is a report about created design of a model for education in mechatronics considered as an interactive educational module capable of teaching participants in training processes to learn the design of products and technology of creating industrial goods in a more efficient manner. Close cooperation of only two institutions supported by additional training in this case were necessary for the proper implementation and understanding of the common objectives in this area and assumptions used to develop a model for use in the field of education.

Successfully integrated model designed to teach control of a computer with a mechanical device is used for application in vocational training and effective use in this field. The key to success in the construction of such complex mechatronic model was the modularity (construction of ready-made components, modular). It is about an approach based on mechatronic modules. Modules as such having clearly defined roles are integrated into subsystems and create “the module”.

From here it is close to consider the general architecture of the whole interactive educational module, appropriate for use in teaching mechatronics. Modularity and dispersal architecture are clear targets in the development of mechatronics. Dispersal in this context means both the decentralization of control functions and spatial dispersion of controls, which also were evaluated by the teacher during the student's progress.

Modularity will also facilitate development work, such as construction, simulation, testing, and further work on the module after the finish of funding from the program. Modularity of construction and equipment helps maintain its technical condition. Report describes both the complexity and leads to simplifying the construction and design/functionality of the module, as well as draw attention to obtaining the appropriate characteristics on the purely educational field, which does not mean at all that designers should not seek to further simpler and more effective design in this range, which takes place in the later results.

Functions that can be used in vocational training through appropriately selected functionality and algorithms of work and adjustment capabilities in this case analyzes the effects and impacts of the model on education processes, rather than removes the causes of the irregularities.

Output 3 - Project of possible model use in enterprises. The application of the practical use of some solutions in mechatronics is more, and some less common, and thereby less needed for labor market in enterprises, so in engineering related to the design, manufacture and operation of the model we took into account the need for solutions for the construction of the module based on the experience of companies in mechatronics industry.

Report describing this output includes:

1. Competition in mechatronics on a global scale,

2. The analysis of product quality,

3. The technical level of production of modern machines, equipment, and methods of construction,

4. Finding methods to reduce costs and increase productivity using model,

5. Development of technology, machinery, equipment, methods and tools supporting the further development and production using knowledge based on model.

Thanks to the experience of entities included in the strategic partnership it was possible to examine the draft terms of usefulness and application to the actual workplace following the path of educational process on the

model: mechanical system -> dynamic model -> control method -> algorithms -> programming processes -> action in real time -> built-in control system -> product effect.

The report therefore takes into account the capabilities and technologies used by real market participants and the actual economic life, i.e. entrepreneurs using or companies having in their production lines mechatronic solutions based on knowledge possible to receive by the model. The criteria taken into account in preparing this outcome includes also three key elements:

1. Market

2. Competitiveness

3. Innovation

As part of the outcome Report gives the answer to the question what kind of tasks shall we teach by the mechatronic module to receive the knowledge which might be used in enterprises. What kind of tasks shall we learn through module by teachers for students of mechatronics and which we can apply. What can be achieved through the integration of mechanical systems with electronic and through the teaching of mechatronics on such a model. What do we require to construct such mechatronic systems. How to reach these requirements. Within the result Report includes a functional description of the device, which can be called the “main flow of information” corresponding to the desired module.

Output 4 - Software and a set of assumptions for vocational training using a model. Whereas changes in vocational education and the opportunity to create formidable solutions affecting the effectiveness of this education within our project was developed as a set of assumptions that affect the quality and excellence of production, which are key to competitiveness and the most important thing in the contemporary mechatronics, or interdisciplinary skills further development of new products, so that their functioning was not only limited by knowledge available at the time they were implemented.

Therefore, a set of assumptions and software created within this outcome are fully technically efficient and functional in IT environment, but with variable characteristics from the time of its production to the ability to further changes. The microcomputer (microprocessor) is, on principle model used for circuit switching, and software as material content of memory. It therefore makes sense to develop such software which will distinguish the states to "usable" device and they will point so that the customer could notice them, and the teacher can evaluate. Therefore, the graph states and states matrix will be used to supplement the description and user dialogue with the module.

Description of the software structure is completed and the information is accompanied by an expected and the possible behavior of all elements of the module and their relationships in the processes of teaching in mechatronics technician profession. The software development finalizes “the design phase” and shows the ability to use different tools and functionality of the module in education of mechatronics, defining: flow of information and data, power and energy flows, states and transitions, process sequences, information processing hierarchy, timing, functional structure.

The concept design for software of such interactive educational module involves:

1. Structure of elements that perform the most important functions of the module;

2. The structure of the interface elements that define the boundaries of the module (student/machine/teacher), system interfaces, and environmental and boundaries between subsystems in electronic and mechanical;

3. The structure of activities, including software instructions for the programmable elements and the expected behavior of the operator;

4. The basic mechanical structure and arrangement of the elements, the project forms industrial production method and so on.

The structure of activities shall contain information about the software instructions which control elements and the expected behavior of the system operator - a student under the supervision of a teacher. Based on previous results we will be able to describe more precisely what we mean by the design concept and understand its use in vocational training in mechatronics technician profession.

Output 5 - Preparation of an interactive module and the technical documentation. A key feature of the output was to build real and physical interactive educational module for teaching mechatronics. On the basis of experience with previous results of intellectual work during the design and construction of mechatronic systems, it is required to balance with multi-disciplines of mechanical (mechanical engineering, precision engineering, technical mechanics), electrical equipment (microelectronics, power electronic, sensor technology, measurement techniques, actors) and information technology (systems theory, automation technology, software design, artificial intelligence).

The module carry out vocational training to new level which would be difficult or even impossible to achieve using traditional approach. Dissemination of solutions requires a new conception of educational activities and vocational education in mechatronics with use of models that will not only teach, but also assess educational progress of training participants.

Effective mechatronic teaching model was not easy to develop, what follows from the very nature of mechatronics - the need to integrate different techniques and hence the need for interaction between these techniques. The prototype module will be prepared in specialist laboratories of the partner. Module provides an educational opportunity to learn the different functions by different techniques.

Information processing is carried out by means of simple algorithms or software modules in a digital computer in real time. These algorithms include freely adjustable parameters that must be adjusted to the static and dynamic behavior of the process. Matching occurs mostly by manual input based on tests or value resulting from experience.

Because the matching process can be very difficult to learn, within the model we try to automate it. In many cases this was done in a manner fit algorithmic by using one of the many methods of designing control systems. For this purpose, we gathered information in the form of all the results from the combined results of earlier intellectual work. With measured and verified input and output values by an appropriate method to identify the process, we got to the design parameters of the dynamic model and the physical form of interactive module for teaching these processes.

The key for the further development and dissemination was also to develop and systematize the technical documentation of this module both for further improvements for educational purposes, as well as the possible use by other entities and stakeholders not directly involved in implementation of the project.

Output 6 - An innovative program using interactive educational module in mechatronics. The concept of the training program is based on so-called "teaching experimental" (learning by doing for action), in which strategy is to gain knowledge and skills by active forms of learning through practical problem-solving, rather than the classic memory mastering of facts.

Therefore, this program distinguishes a large number of experiments, exercises and technical projects based on the use of interactive educational module in the learning context of vocational subjects, but also in physics, mathematics, or computer science. It can be assumed successfully assumption that develop among participants in vocational training in mechatronics skills of design and construction on module allows the independent investigation to understand their technical issues in different areas.

An important functionality of such courses is that students learn and improve technical cooperation in groups, acting under real constraints of time and material resources. This is important from the point of practical view, because the students participating directly in the activities acquire the knowledge and programming skills, product design and manufacturing processes, which then gather at the site of its future work in enterprises or factories using such solutions and operating with the same constraints as students in the class.

The program includes program instructions in all stages covered by the support under the project partners supervision. Not only teachers of vocational subjects, but also teachers of physics or computer science can take inspiration from innovative forms of implementation of tasks using an interactive educational module, using CAD software, microprocessors, robots, etc.

The program is therefore a complete and comprehensive development of ready to use “module” in vocational training for all operators willing and interested, indicating mechatronic new learning approach for technologies, improve their technical culture and making it possible to implement in practical design at work.

An innovative program of use of interactive educational module in mechatronics have a huge impact on students learning in the field of mechatronics, which directly correspond to building a future engineering and technical personnel of economy and labor market.

TOPIC 1

Giving all the users an introduction to Arduino programming is crucial to achieve adequate level of knowledge needed to start understand and operate on the platform. This topic is divided into three main parts.

First one containing short Cheat Sheet in .pdf format is aiming to give a user quick access or review of basic commands on structure and flow operations, operators itself, libraries, variables constants and arrays as well as main build-in functions. It also contains schematic images and basic input/output states.

Following guide also in .pdf format is an introduction to Arduino where users can learn basics of Arduino if they are a beginner users or review some concepts if they are an advance users. Introductions gives an image about what is Arduino, it describes hardware including boards comparison. It contains Arduino uno general information, its characteristics, power, memory, input and output states, software reseting and communications issues. It also answers the question how you can break Arduino uno.

Introduction also contain a software description, informations about installing Arduino software, using Arduino ide, its main buttons and menu bar. Useful schematics are at the final pages of the introduction document.

The topic is ended with questionnaire in quiz format which plays the role of both, knowledge check and self-assessment tool for more advanced users, defining the point “where should I start” working with the Edutronix platform.

TOPIC 2

This part is a follow up to the previous introduction with more focus on programming in Arduino. 10 corresponding parts guides all the users either they are beginners or advanced through all the basic topics connected with programming in Arduino.

Starting with Arduino programing needs at least a basic knowledge about its structure, variables and data types while operating the platform. It also contains information about arithmetic and operators and constants. It gives a guide for flow control, digital and analog inputs/outputs and serial communication. Also other useful functions like time, random numbers and mathematics are described by this topic making this part a really brief and useful for all the possible users. The document is short, to preserve good readability and in .pdf format.

TOPIC 3

This part introduces possibilities of graphical programming using mBot and mBlock preceded by a movie on YouTube showing the actual operating device programmed in that way – so called “line follower”.

Booklet about mBot is short and presented in a very reader friendly way. It contains a lot of graphics and screenshots corresponding to introduction, information on how to connect and presenting programming issues. It also contains exercises to practice those skills, which is the most important and relevant part of this document.

Much more extensive is a book about mBlock. It is a really comprehensive document as it contains Pre-Learning Preparation. Each of 14 separate Chapters includes its learning objectives, electronic modules descriptions used in the exercises, knowledge points being like a milestones to achieve. It gives a clear overview of programming structure and ideas with some tips and so called “try it” section in each chapter. Every one of those also includes example expansions and practical exercises.

Such structure enable all the users to get familiar with mBot and mBlock structures of programming in a very descriptive and practical way, with educational attitude related to the project goals but clear enough to make it possible being used by students themselves without much involvement of the teachers at this stage.

TOPIC 4

Presents all the resources needed to make full use of Edutronix platform capabilities. List of all the components used and needed to reach all the milestones and create all the mechatronic devices described on the platform is in one clear .pdf file.

Quite similar role has the libraries list where without going through the information on the whole platform and seeking for needed software you can refer to both of those lists to have a full set of elements. It is both a kind of minimum and a starter.

To make it even easier for the users to start working with our platform and Arduino a ready to use list of websites on which the users can buy toolbox elements was prepared by our project team. On our platform you can also download ready to use, checked and safe libraries mentioned above.

Platform gives you an opportunity to make use of our 3D printer models in .stl files to create your own Edutronix bases. STL (STereoLithography) is a file format native to the stereolithography CAD software. It has several after-the-fact backronyms such as "Standard Triangle Language" and "Standard Tessellation Language", but this file format is supported by many other software packages and it is widely used for rapid prototyping, 3D printing and computer-aided manufacturing. All the files describe the surface geometry of a three-dimensional object without any representation of color, texture or other common CAD model attributes so it describes a raw unstructured triangulated surface by the unit normal and vertices (ordered by the right-hand rule) of the triangles using a three-dimensional Cartesian coordinate system. The files available on the platform makes it possible to create full package including: base and car support, cover, motherboard and 2 versions of Edutronix bases.

TOPIC 5

This is a part where the users start to do a real exercises and make a real use of the platform itself. It starts with a basics. The users are able to go through 23 exercises starting to work with programming, modules, elements and devices on Edutronix platform using sensors and actuators from a previously prepared list.

Both variety and diversity of an exercises selected by Edutronix team makes it possible to go through and learn all the skills needed in the future use of the platform and use of mechatronic devices itself. This part is a must for all the users that are not really good at mechatronics giving them from the very beginning a possibility not to miss any important part of the basic knowledge in that field.

Each exercise is structured in a well-known way from the previous topics (ie. Topic 3), giving a short introduction, information about connections and programming. The selected exercises includes:

1. Connecting a LED (Actuator)
2. Connecting a Button (Sensor)
3. Connecting a Capacitive Touch Sensor
4. Connecting a Potentiometer (Sensor)
5. Using Serial Port (Communication)
6. Connecting a Switch (Sensor)
7. Connecting a Buzzer (Actuator)
8. Connecting a DC Engine and Decelerator DC Engine (Actuator)
9. Connecting a LCD (I2C) Screen (Actuator)
10. Connecting a Stepper Motor (Actuator)
11. Connecting a Force Sensitive Resistor (Sensor)
12. Connecting a LDR (Sensor)
13. Connecting a Temperature and Relative Humidity Sensor
14. Connecting a PIR Sensor
15. Connecting a Hall Sensor
16. Connecting a Gas Sensor
17. Connecting a Water Level Sensor
18. Connecting an Ultrasonic Sensor

19. Connecting an Infrared Obstacle Detector Module (Sensor)

20. Connecting a LED Display (Actuator)

21. Connecting a LED RGB (Actuator)

22. Connecting a RGB Ring (Actuator)

23. Connecting a Servo Motor (Actuator)

All of the exercises are with a good readability format in short and separate .pdf files.

TOPIC 6

This is a part where the users follow with even more exercises using 5 different communication methods with module. Again the variety and diversity of an exercises selected by Edutronix team makes it possible to go through and learn all the communication possibilities and possible use of the platform and use of mechatronic devices itself.

Each exercise is structured in a well-known way from the previous topics (ie. Topic 3, 5), to follow good practice and to be more intuitive, giving a short introduction, information about connections and programming. The selected exercises includes 5 most widespread, convenient and popular ways of communication witch such a devices:

1. Using Serial Port
2. Wireless Controller
3. RFID
4. Bluetooth
5. WI-Fi

All of the exercises are with a good readability format in short and separate .pdf files.

TOPIC 7

This is a part where the users brings into play 10 ready to use projects within the Edutronix platform. Each project is structured in a well-known way from the previous topics (ie. Topic 3, 5, 6), to follow good practice and to be more intuitive, giving a short introduction, information about connections and programming.

The selected projects includes 10 devices using different parts and methods of their creation. It also finally shows that creating a mechatronic device can be used in “real life” helping to achieve different goals or perform a wide variety of tasks. For better visualization, projects also include pictures of devices already created by Edutronix team. The devices are as follows:

1. Candle Light
2. Push Button
3. Ultrasound Buzzer
4. LCD Force Temperature
5. Sensors on LCD
6. Thermostat
7. Parking Control
8. Simon Says
9. 6Servos ARM
10. Bluetooth Car

All of the exercises are with a good readability format in short and separate .pdf files.

ANNEX 1, 2, 3 and 4

For educational purposes and for creating a more structured way of presenting all the exercises and possibilities of the Edutronix platform, the creators decided to prepare an Annex 1 which does not contain new materials, but it contains just a sensor exercises list with links used with the Edutronix module. On the same way Annex 2 contains an actuators exercises list used with the Edutronix module while Annex 3 contains a list of all exemplary exercises which might be performed on Edutronix platform.

Annex 4 contains complementary documents about Fritzing and App Invertor for more advanced users. It is describing an open-source software for documenting prototypes, learning interactive electronics and PCB production. In a very descriptive way with lots of photographs and examples the publication shows the reader what exactly is Fritzing and what is it for. It also describes who uses Fritzing and how. It contains Fritzing development model and set of features, quality, the Friends-of-Fritzing NPO, its mission and future with a description of all Fritzing team members.

The book about App Inventor with its step-by-step picture tutorials guides users through making a mobile applications they can create by them own. It contains four simple tutorials for getting started with App Inventor, which includes:

1. TalkToMe – which supposed to be a starting point and a first App Inventor mobile application created by the user

2. TalkToMe Part 2 – which is an add-on for a previous one showing more sophisticated shaking and user input possibilities

3. BallBounce – which aims to create a simple game

4. DigitalDoodle – and finally the most comprehensive out of those four – a drawing mobile application.

All of those tutorials step-by-step, in a descriptive and reader friendly way, with lots of screenshots guides the users to follow the instructions and lures them to go even beyond the point of knowledge and skills they already reached, just for fun at the beginning but for an aimed goal at the end – to develop. Both publications are in .pdf format.

MATERIALS SECTION

Materials section contains 24 lessons of different topics while every topic is also divided into few more readable pages with graphs and pictures for better visualization of the topic. The main aim of this part is to be a compendium of knowledge for everyone who might be interested in using the Edutronix platform but have not yet reached a knowledge level necessary to operate in mechatronic field. It is quite complicated as it combines many fields: electronics, informatics, mechanics, automation and robotics so our materials prepared by the project team in one easy to access way on the platform shall help to acquire this part of knowledge and might help to reduce the gaps. All the lessons are in separate parts so the user can stop and come back to the place where he or she finished easily.

The corresponding number of tests for self-assessment was prepared also for a validation of this part of theoretical and practical knowledge and skills which might be assessed on the platform by both user (on the basis of user reports) and teachers in school or trainers in the companies. It gives a possibility to grade all of 24 items, showing calculated weight, grade, range, percentage, feedback, contribution to course total and finally giving an Edutronix course total at the end.

All of the lessons are in a lesson type format on the platform and tests are in a quiz format (same as a questionnaire in Topic 1).