



ARDUINO EDUCATION ENGINEERING KIT REV2



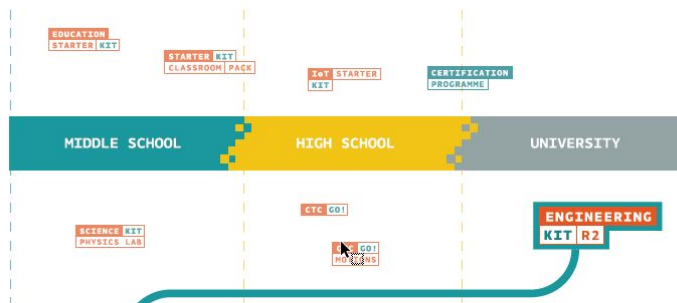
ARDUINO EDUCATION KIT FOR ENGINEERING STUDENTS

STUDENTS LEARN KEY MECHATRONIC ENGINEERING
CONCEPTS WITH MATLAB/SIMULINK PROGRAMMING
THROUGH A LEARNING BY DOING APPROACH

ARDUINO EDUCATION LEARNING EVOLUTION

ARDUINO® EDUCATION LEARNING EVOLUTION

Our aim is to help students achieve their dream careers in STEAM. Our cross-curriculum content and open-source approach are essential tools for STEAM classes that develop with students as they progress through middle school, high school, and university, preparing them for a successful future.



Step by step, we champion students as they progress through their STEAM education with projects that increase in complexity to challenge them as they develop their skills.

We support students in achieving successful careers in STEAM-related fields with educational kits that are targeted to their age and ability. The technology is practical, creative, and fun. Students learn using the same products that companies around the world use in applications like rapid prototyping, AI, drone technology, and developing machine learning.

We are currently focused on translating our content into more languages and mapping it to more curricula. If you have a project that you would like to have localised for your country, please contact us with your suggestion.

For more info visit: [ARDUINO . CC / EDU](https://www.arduino.cc/edu)

The Arduino Engineering Kit won the Higher Education or Further Education Digital Service category at the BETT Show 2020.

Judges comments was:

“The Arduino Engineering kit is a well-designed, innovative toolkit that enables engineering students to use industry standard software to complete interesting, engaging and relevant projects ”

BETT SHOW, 2020



WHAT IS THE ARDUINO ENGINEERING KIT REV 2 ?

The Arduino Engineering Kit Rev 2 provides students a strong understanding of basic engineering concepts through fun projects. Students are able to connect what they learn with real-world industries, are encouraged to think critically, and improve their depth of knowledge by learning through experimentation. The kit is a versatile, hands-on learning tool that demonstrates key control systems concepts, core aspects of mechatronics, and MATLAB and Simulink programming. Ideal for advanced high school and college students.

"It is useful exercise for the students to build something operable, and to experience the interaction between modelling and actual use."

Andrew Belford, Educator at Macquarie University



FEATURES OF THE ARDUINO ENGINEERING KIT REV 2

Features of the Arduino Engineering Kit Rev2:

- Designed for use in practical lab sessions
- Students can learn and apply their beginners' knowledge of MATLAB and Simulink
- Opportunity for lots of experimentation for both educators and students
- Can be adapted to suit remote learning situations



BENEFITS OF THE ARDUINO ENGINEERING KIT REV 2

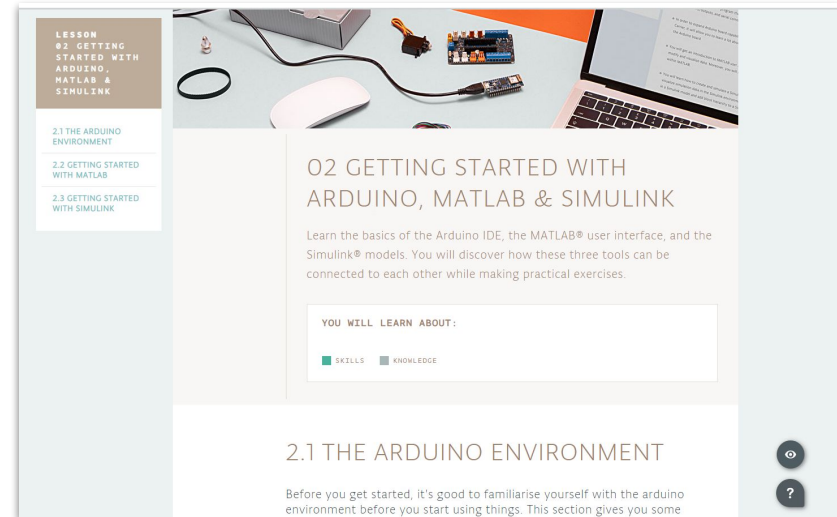
- Extensive learning outcomes provide students with a strong understanding of basic engineering concepts.
- Students want to learn because the projects are fun and create an outcome-driven environment.
- Broaden your students' 21st-century skills with collaborative learning and problem-solving, and challenge them to think critically.
- Help students connect their knowledge with real-world industries.
- Educators can freely tailor the kit to their students' needs and their own curriculum.
- Improve depth of knowledge by learning theoretical concepts in a hands-on way.



KEY LEARNING VALUES

The online platform helps students learn fundamental engineering concepts, key aspects of mechatronics, and MATLAB and Simulink programming. Learning values include:

- System modeling
- Control theory
- Robotics and mechatronics
- Image and video processing
- Text-based programming with MATLAB
- Visual programming with Simulink
- How to analyze and visualize data



KEY LEARNING VALUES

- Applying custom algorithms for complex math operations, image processing, and PID control
- How to model and simulate behavior of dynamic systems
- How to incorporate logic-based algorithms that define system behavior for different “states”, for example, move forward, turn, stop



WHAT'S NEW IN THE ENGINEERING KIT REV2?

- Optimized compact hardware design with the new professional Arduino Nano 33 IoT
- Improved battery management with the custom Nano Motor Carrier Board
- Improved box and kitting for better classroom management and cargo safety
- Enhanced robot performance with new Simulink models
- Reduced assembly time and improved overall performance with better mechanical structure designs
- Content is upgraded and available on a new online platform for better user experience
- Upgraded MATLAB and Simulink to 2020A version



WHAT'S INCLUDED



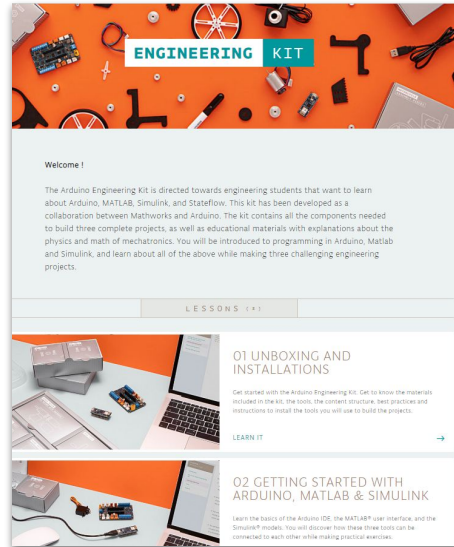
HARDWARE



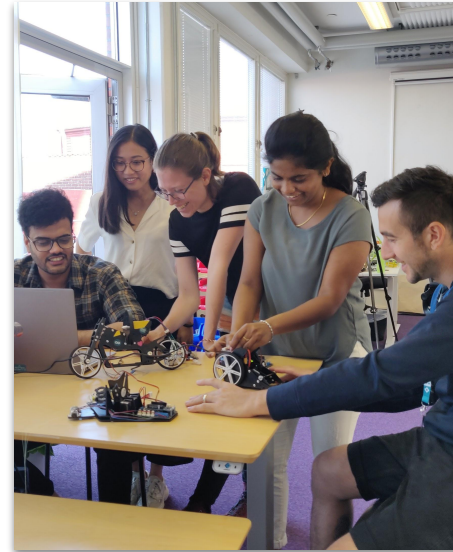
SOFTWARE



WHAT'S INCLUDED



CONTENT



SUPPORT





HARDWARE



The components come inside a hard plastic, stackable toolbox ideal for storage and years of use

The kit includes all the physical components you need to build the projects :

- Arduino Nano 33 IoT
- Nano Motor Carrier with IMU and battery charger
- Three sets of mechanical pieces to assemble the projects
- Li Ion 18650 battery
- Two geared motors with encoders
- DC motor with encoders
- Servo motor
- USB cable
- Two whiteboard markers
- Two wheels
- Allen key
- Webcam
- Nylon thread
- Screws, nuts, and bolts

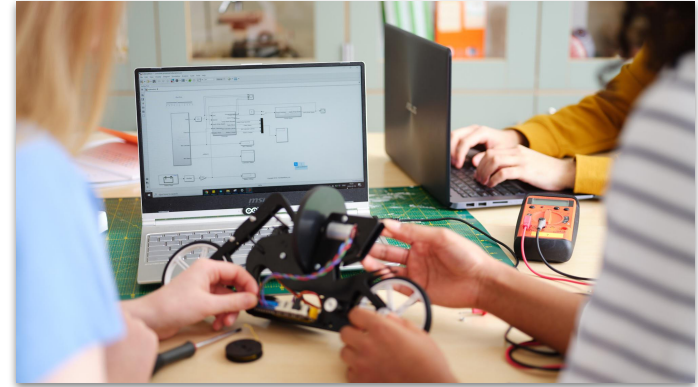




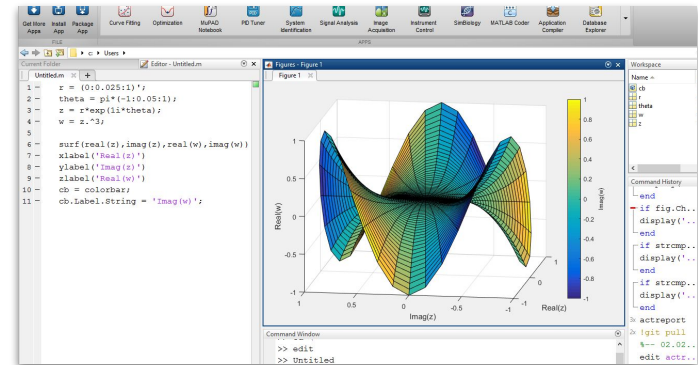
SOFTWARE

SOFTWARE DEVELOPED IN PARTNERSHIP WITH MATHWORKS

- Includes **one year individual** license of Matlab & Simulink providing with hands-on experience in system modeling and embedded algorithm development.
- All downloadable packets are provided by MathWorks



MATLAB®
& SIMULINK®





CONTENT

CONTENT OVERVIEW

The kit includes online learning materials with step-by-step instructions and lessons called chapters, ideal for advanced high school and college students working in small groups or for facilitating remote learning. Students and professors can use this versatile kit's content as the core of a new engineering mechatronics class or freely adapt the content to their own needs and curriculum.

The content is divided in six chapters that cover topics like getting started, introduction to mechatronics, and a in-depth step-by-step guide on how to build, design and program the three projects.




INSIDE THE LESSONS

LESSON
01 UNBOXING
AND
INSTALLATIONS

1.1 ABOUT THE KIT

1.2 LEARNING
OBJECTIVES

1.3 INSTALLING THE
TOOLS



01 UNBOXING AND INSTALLATIONS

Get started with the Arduino Engineering Kit. Get to know the materials included in the kit, the tools, the content structure, best practices and instructions to install the tools you will use to build the projects.

YOU WILL LEARN ABOUT:

SKILLS

KNOWLEDGE

1.1 ABOUT THE KIT



The Arduino Engineering Kit comes with a set of electronic components, assembly pieces, software tools and educational materials that you will need to build the projects.

In this section you will learn:

- ♦ About the various electronic components and other materials in the box.
- ♦ How the educational materials have been organised and their usage.
- ♦ About the purpose of the Arduino and Matlab software tools.

IN THE BOX

This section is a complete description of all the materials and components included in the kit, some of them you might be familiar with already, others will be completely new to you.





INSIDE THE PROJECTS

PROJECT 05 MOBILE ROVER

5.1 CONTROL THE
ROVER AND FORKLIFT
FROM MATLAB

5.2 SIMULATING
ROVER KINEMATICS
AND OPEN LOOP
CONTROL

5.3 CLOSED-LOOP
CONTROL OF ROVER
POSITION

5.4 PROGRAM ROVER
TO FOLLOW PATH
INSTRUCTIONS

5.5 LOCALIZATION TO
CALCULATE ROVER
POSITION

5.6 NAVIGATE THE
ARENA AND MOVE THE
TARGET

5.7 CONTROL THE
ROVER OVER WI-FI

5.8 LESSONS LEARNED

5.9 FINAL CHALLENGE



LEVEL OF DIFFICULTY:

programming



● ○ ○ ○ ○

hardware



● ○ ○ ○ ○

assembly



● ○ ○ ○ ○

05 MOBILE ROVER

Build and program a mobile rover to follow paths, move objects with a forklift, and avoid obstacles. You will learn about differential drive robots and how to simulate their behavior, control their position or speed, and perform localization.

YOU WILL LEARN ABOUT:



SKILLS



KNOWLEDGE

5.1 CONTROL THE ROVER AND FORKLIFT FROM MATLAB

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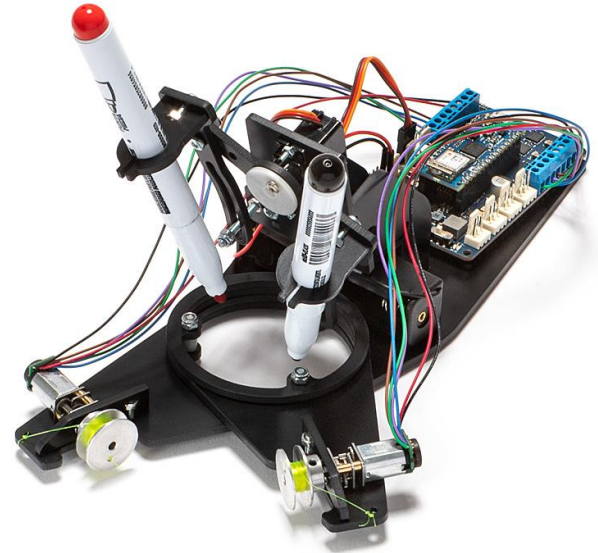




HANDS-ON PROJECTS

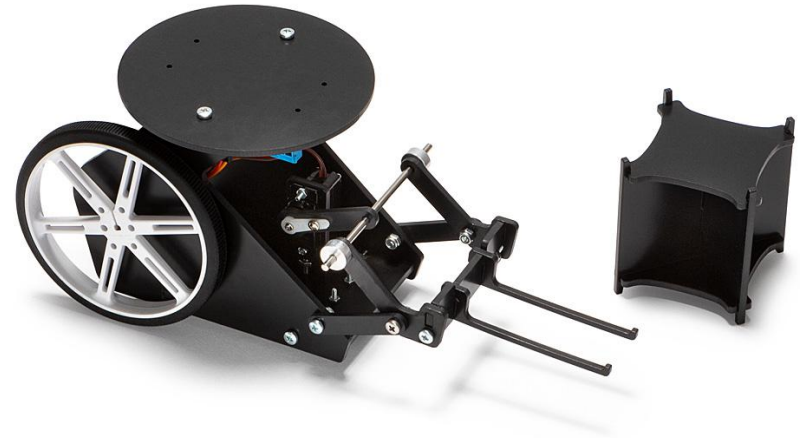
DRAWING ROBOT

- **IMAGE PROCESSING:** Apply filters to images to detect the borders and identify the lines to be drawn.
- **MATHEMATICAL TRANSFORMATIONS:** Mathematical movement concepts to transform the pixels position to motor commands
- **TRIGONOMETRICS:** Trigonometric concepts that allow knowing the position of the robot
- **MATLAB PROGRAMMING:** Use Matlab to create the algorithms to control the robot



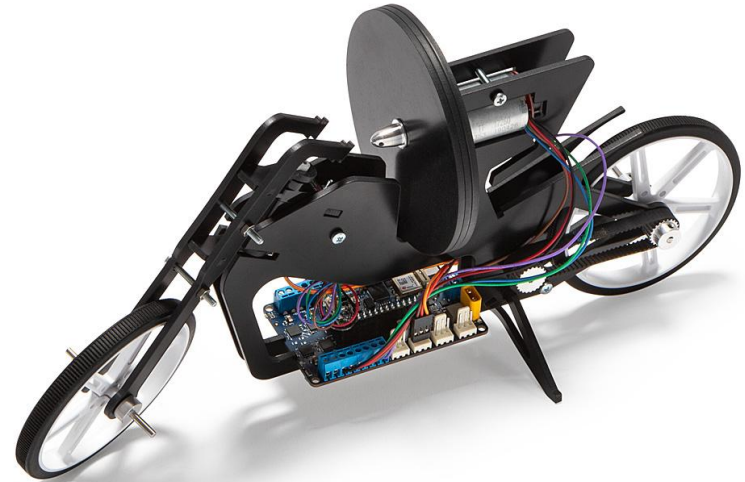
WEBCAM CONTROLLED ROVER

- **PID CONTROL:** Use control systems to accurately set motors position
- **VIDEO PROCESSING:** Real time image processing using a webcam to locate the robot position on the arena and detect obstacles
- **MATLAB AND SIMULINK PROGRAMMING:** Use Simulink models to create a state machine algorithm



SELF-BALANCING MOTORCYCLE

- **PID CONTROL:** Use control systems to keep the motorcycle standing using an inertia wheel
- **PHYSICS:** Learn the physics principles behind the technology used to keep the motorcycle balancing
- **SIMULINK PROGRAMMING:** Use Simulink Use Simulink to model reactive systems and design feedback control algorithms.

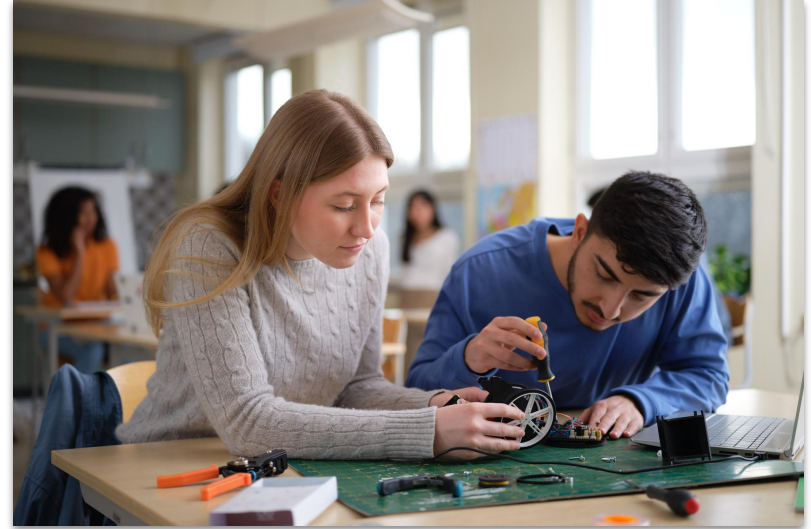




ADAPTING THE KIT & FURTHER EXPERIMENTATION

ADAPT THE KIT TO YOUR OWN NEEDS

Educators can freely tailor the kit to **their students' needs and their own curriculum**. You can use this versatile kit as the core of a new engineering mechatronics class or freely adapt the content to your own ideas and experiments while implementing MATLAB and Simulink, for example as part of **laboratories and final projects**.



[illegible]

Students can also buy the kit and use it to experiment at home and for extended learning.



**THANK YOU FOR YOUR
TIME!**

ANY QUESTIONS?