Education and Culture DG
Lifelong Learning Programme

The Handbook of the EU Project ROBGAP

Robots for inter-generational gap


Education and Culture DG
Lifelong Learning Programme


ROB
GAP

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Introduction to the project

The Project “Intergenerational Gap” Robgap is a Learning partnership project supported by the European Commission through the National Agencies within the framework of theLifelong Learning Programme. The aim of the project was the involvement of senior people, grandparents, parents, adults and teachers from any social groups to be trained and to be technologically advanced to stay with their children, mediating educational contents like maths, science, dynamics, geometry using the robots. The project contributed to social inclusion / valorization of the competencies , acquisition of new competencies, and active participation of senior people in the educational process, promoting a new role and mediating through this role new learning process of ICT world. The project therefore aimed to make grandparents knowledge technologically advanced to re-qualify their role with nephews and children, teaching them how to program robots and how to use robots for educational motivation and involvement with children. It also aimed to develop the target group skills and competencies such as communication, ICT literacy, robot programming, maths, science and geometry subjects / topics. The project model was embedded to ensure long-term sustainability of the self-support and competence development activities.

Partners

This project involved from 2011 at 2013 differents European countries and institutions:

- School of robotics (Italy) (Coordinator)
- Istituto Comprensivo di Caldiero (Italy)
- Action City (Greece)
- Latvian Adults Education Association (Latvia)
- Hitecho (Lithuania)
- I.E.S. Pedro Mercedes (Spain)
- Anadolu Kalkınma Değişim ve Gelişim Derneği (ANKA-DER) (Turkey)
- Aktive Akademie 50+ GmbH (Germany)

Presentation of Partners

School of Robotics

“Scuola di Robotica” is a non profit cultural association whose aim is to promote the knowledge of the science of Robotics among students, teachers and the general public.It provides for the widest practicable and appropriate dissemination of information concerning the results of the R&D in the field of Robotics and of the complementary disciplines, namely Artificial Intelligence, Neuroscience, Philosophy, Psychology.
The mission of “Scuola di Robotica” is to develop a chain of transmission between research laboratories, education, industry and society at large, because without an effective translation between the language of science and those of other disciplines, communication of science is incomplete.When Robotics will be applied to society in numbers and volumes bigger than today, it will trigger widespread social and economic

change, for which public and private policy must now prepared. School of Robotics investigates the ethical dimension of Robotics in collaboration with scholars of several disciplines (Humanities).
“Scuola di Robotica” organises: conferences, classes, videoconferences, documentaries, publications and events, based on the pedagogical principle of “live science”, structured to close the bridge between society – primarily the school - and scientific research in the field of ICT and Robotics.
“Scuola di Robotica” was born from the interdisciplinary association between the know-how in the field of Experimental Robotics achieved by Gianmarco Veruggio and Riccardo Bono of CNR-Robotlab, and the philosophical background, and the experience in the field of Science Communication, achieved by Fiorella Operto.
Moreover “Scuola di Robotica” founders have deep experience of EC Research Projects and of a working philosophy based on the concept of the Virtual Lab made possible by Internet.
This will permit to lead the multidisciplinary working group that will develop the H/W and S/W educational kit and of the specific programs to exploit it within the project.
It is the deep conviction of the founders of “Scuola di Robotica” that Science popularization shall employ new and fresh cultural and communication methods. Not only is Robotics one of the youngest sciences, coming out from the contamination of several other branches of investigation; but the ways to communicate it should be conformed to the new technical and telecommunication means.

Website: www.scuoladirobotica.it

Istituto Comprensivo “Pisano” Caldiero

“A. Pisano” Institute is located in the north-east of Italy, 15 km far from Verona and consists of two buildings located in two different villages called Caldiero and Belfiore. There are 12 classes at Caldiero Secondary School and 4 classes at Belfiore Secondary School. The school in Belfiore has got three well-equipped laboratories where students can study and carry out experiements: one of applied sciences, one of astronomy and one of information technology. In the last few years the school in Belfiore has taken part in several national and international scientific projects, for example the “The network of Erathostenes”, “The sunrise project” and “The
solar center project”.“Robotics ” is the latest project introduced in the school program.

Action City

Action City was founded in 2009 and is a non-profit organization. Purpose of Action City, its founders and its supporters is to develop adults’ skills through educational, cultural and other activities. The protection of the environment, the promotion of information society and of public health are additional fields of activity of the organization and its members. The composition of the General Assembly of Action City is fully balance with respect to the gender of the participants (50% -50%).According to its Statute, the Action City is not associated with any political party organization in Greece and / or abroad. It develops no political action and it operates without any ethnic, religious or other exclusions.

It is a standard policy for Action City to organize all its activities to places fully accessible by people with disabilities. The Action City is an equal opportunity employer and does not exclude employees and supporters on the basis of gender, origin, religion, socio - economic status or other criteria that may oppose the policy of equal access to employment and education.

LAEA - Latvian Adults Education Association

LAEA is a non-governmental and no profit national society that provides Adult Education in Latvia since 1993.At present the LAEA has 57 Member organizations. Most of them deal with non-formal AE. According to their legal status they are:
- Adult Education Centres, Folk Schools
- Local authorities
- Non-governmental organizations
- Private companies and in-service training centres of enterprises
Universities, evening schools, vocational schools

HITECO - High Technology for Cooperation

VŠĮ HITECO established as an independent branch of IMOTEC, in Vilnius, 2008
Connecting experts from inside and outside Lithuania (eg. Italy)
It operates in the open source community, designing and developing tools and applications both for web and mobile and offering consultancy for the professional visualization on the web.
Its a small, flexible enterprise for creative web/mobile solutions. HITECO develops and updates free, educational and useful software and releases them on the web in open source mode. HITECO offers consultancy to design and develop communication tools (websites, on-line and off-line ICT support, graphic design, web content management and visionary art).

I.E.S. Pedro Mercedes

IES Pedro Mercedes it's a College-High School with over 1.300 pupils.
It's a PUBLIC Center for secondary and vocational training.
It's placed in a social environment medium-low.
Their Challenges:
- Fight against school fail.
- Involve families and all the education community.
They have different high school choices in their center:
1. Bachillerato Tecnológico (Studies on Technology).
2. Bachillerato de Ciencias de la Salud (Studies related to Healthcare and Paramedics).
Bachillerato de Ciencias Sociales y Humanidades (Studies related to Geography, History and Arts).

Anadolu Kalkınma Değişim ve Gelişim Derneği (ANKA-DER)

The aim of this society is:

- support all kind of projects for the development and improvement of the region
- raise awareness of project implementation
- promotes national and international co-operation
- train young people
- supports ICT among the partners and innovative methods related to subjects which is useful for the region as a modern association.

Aktive Akademie 50+ GmbH

“Active Akademie +50” is a Department of the “Institut50Plus” devoted to the physical and psichological wellbeing of Women and Man over 50 years. It is based in Weimar, Germany. The Active Akademie+50 carries out all the artistic, intellectual, and scientifici activities and learning programs by which people over 50 can keep up with the cultural and technological developments in society.
“Active Akademie +50” organized workshops and classed, journey and cultural visits focused on updating people about Arts, Science and Societal issues.

Why robotics to reduce intergenerational gap?

Robotics combines subjects already rooted in our culture like mechatronics and electronics, with new subjects as Computer Science and Telecommunications, which strongly entered in our daily life. Moreover, Robotics is more than the sum of all its parts (Computer Science, Electronics, Automatica, Control&Communication, and so on) because it appears as a new science, able to both attract and involve young people, also allowing “old” generations to prove themselves and their knowledge.
Through robotics, the generational gap could be filled by the art of “doing together”, by collaborative and cooperative learning.
Here, sharing of knowledge is the key: young people are get ready to value adults knowledge and mechanical skills, while adults take advantage of young people’s cleverness in ICT issues. That is why Robotics amounts to an intergenerational, and intercultural passepartout, a common ground where generations can dialogue, share idea, growing together.
Another benefit from Educational Robotics, which concerns the improvement of the work environment in general, is the acquiring the habit of cooperation, of comparing our own skills: this could advantage different generations to improve integration at work.

Our Logo

The partners of RobGap drew up the logo inspired by the robotics kit most employed during the project workshops. The split between the two words Rob and Gap, composing the headline, allow us to insert two “eyes”, that mean both the “eyes” of the robot, and the human sense of the sight. Of all the faculties, sight is the sense that occupies the most important fraction of our brain activity. About the colours. The grey reminds us about technology and robotics, it the main colour of the machines. On another side, orange reminds us about the warmth of human relationships, which are key in any activity, but especially in the relationships in any educational activity.

Why Lego Mindstorm NXT?

A lot of different robots are on the market and School of Robotics in a different EU Project (Called Robodidactics) leaded a survey about “Educational Robot kit”, from this survey we can choose to use the Lego Mindstorm NXT. In the RobGap project we need a kit easy to assembly and disassembly (for children and adults), with an iconic software but with the possibility to upgrade with different softwares as Scratch, C++, Java, LabView, Phyton etc. In the market the only one robokit which is near to this request is LEGO MINDSTORMS NXT. In this table we presents technical features of the Lego Kits, in retail version. (NOT educational version)

Description	Quantity
NXT Intelligent Brick	1
Motor with odometric sensor	3
Ultrasonic Sensor	1
Light/Color Sensor	1
Touch Sensor	2
NXT - G Software	1
612 pieces	-
Price	**300,00 Euro (VAT Inc)**

Learning Modules

Introduction to robotics

“What is a robot?” is the first question to answer in any robotics laboratory as people can have weird, confused ideas about robots. It is therefore important to clarify that there are many different kinds of robotics and many different applications: for example robots that help astronauts in special missions, robots for car industry, robots for surgery, robots used in films and home robots such as rumba, the first cleaner robot etc. The “Ciaorobot” film from youtube can help handle this presentation part. (see at http://www.youtube.com/user/wodanproduzioni)
Before starting to build a robot We have to define a robot, this definition is important:

“The word robot can refer to both physical robots and virtual software agents, but the latter are usually referred to as bots. There is no consensus on which machines qualify as robots but there is general agreement among experts, and the public, that robots tend to do some or all of the following: move around, operate a mechanical limb, sense and manipulate their environment, and exhibit intelligent behavior — especially behavior which mimics humans or other animals.
There is no one definition of robot that satisfies everyone and many people have their own. For example Joseph Engelberger, a pioneer in industrial robotics, once remarked: "I can't define a robot, but I know one when I see one."According to the Encyclopaedia Britannica a robot is "any automatically operated machine that replaces human effort, though it may not resemble human beings in appearance or perform functions in a humanlike manner." Merriam-Webster describes a robot as a "machine that looks like a human being and performs various complex acts (as walking or talking) of a human being", or a "device that automatically performs complicated often repetitive tasks", or a "mechanism guided by automatic controls".n practical terms, "robot" usually refers to a machine which can be electronically programmed to carry out a variety of physical tasks or actions. “ (From Wikipedia)

“Can we build a robot alone?” is the second question to answer and the answer is “yes, we can but ….” we'd better not to as robotics needs a team work. “What kind of team? Homogeneous or mixed? People of the same age, sex or interests or miscellaneous people taken from different social groups? Of course, the second is the case if we want to achieve the final project goal to reduce intergenerational gap by merging together adults' and children's different competences: young people are very good engineers as they can easily assemble a robot in a short period of time while the same task can take adults hours of work! On the contrary children lack the necessary knowledge to program a robot while adults are usually good programmers.

Whatever the robot you make, first you need to have a goal. In robot competitions you can design robot arms and different systems with the aim of following a the line or throwing

rival mini sumo robot out of dohyo in a short time or, sensing robot's obstacles that runs out of stumbling blocks to maintain their moves without crashing or, to use for exploration, security, cleaning even industrial automation. In order to decide robot's aim, it needs to have sensors which provides robot be in contact with surroundings. When robot's aim is decided, it has already been cleared that it is required to perceive the changes around (Rival robot, white line, warm degree, dampness degree etc.). Each data needs different sensors. In order to determine which sensor to use, do your research and you can take the next step when you have learnt which sensor you need to use.

Description of the Kit - Hardware

The NXT Brick is the brain of a MINDSTORM robot. It's an intelligent, computer-controlled LEGO brick, tgat lets a MINDSTORMS robot come alive and perform different operations. Motor ports. The NXT has three output ports for attaching motors – ports A, B and C.

Sensor ports
The NXT has four input ports for attaching sensors – Ports 1, 2, 3 and 4.

Connections with devices
Connect a USB cable to the USB port and download programs from your computer to the NXT or upload data form the robot to your computer.

Loudspeaker
Make a program with real sound and listen to the when you run the program.

Sensors
You can connect several sensors to the NXT and all of them have a different purpose.

Color Sensor
The Color Sensor is one of the sensors that gives your robot vision (the Ultrasonic Sensor is the other).
The Color Sensor actually has three different functions in one. The Color Sensor enables your robot to distinguish between colors and light and dark. It can detect 6 different colors, read the light intensity of colored surfaces. The Color Sensor can also be used as a Color Lamp.

Touch Sensor
The Touch Sensor gives your robot a sense of touch. The Touch Sensor detects when it is being pressed by something and when it is released again.

Ultrasonic Sensor
The Ultrasonic Sensor is one of the two sensors that give your robot vision (The Light Sensor is the other). The Ultrasonic Sensor enables your robot to see and detect objects. You can also use it to make your robot avoid obstacles, sense and measure distance, and detect movement.

Sound Sensor
The Sound Sensor makes your robot hear! The Sound Sensor can detect both decibels (dB) and adjusted decibel (dBA). A decibel is measurement of sound pressure.

Servo Motors
The three Servo Motors give your robot the ability to move. In each motor there's a built in Rotation Sensor. This Sensor lets you to control your robot's movements precisely.

Description of the software - NXT-G

LEGO Education and National Instruments jointly developed the LEGO® MINDSTORMS® Education NXT software. The software has an intuitive drag and drop interface and graphical programming environment that makes it easy enough for a beginner yet equally powerful for an expert. LEGO MINDSTORMS Education NXT software is an optimized version of the professional NI LabVIEW graphical programming software used by scientists and engineers worldwide to design, control and test products and systems such as MP3 and DVD players, cell phones, and vehicle air bag safety devices.

Block	Descritption	Icon
Move Block	The Move block makes your robot Motors move or Lamps turn on.	
Record/Play Block	The Record/Play block enables you to program the robot with physical movement - and later play back the movement elsewhere in the program.	
Sound Block	The Sound block enables your robot to make sounds, including pre-recorded words.	
Wait Block	The Wait block makes your robot wait for sensor input, such as a sound or a time interval.	

Block	Descritption	Icon
Loop Block	Use the Loop block if you want your robot to continue to do the same things again and again, such as moving forward and backward until a Touch Sensor is pressed.	
Display Block	The Display block enables you to control the display on the NXT. You can type, show icons or even draw through your program.	
Switch Block	The Switch block enables the robot to make its own decisions, such as going left when it hears a loud sound and turning right when it hears a soft sound.	

How to use sensors

We are going to test different sensors, by using programming unit in “try me” mode.The aim of this module is discover cause-effects relationships between sensors, environment and robot.
We want to learn cause – effect relationships and we have to describe them.

Step 1 - Testing sensors

•Go to “try me” icon by using cursors
•Push orange button
•Select the sensor to test
•Push twice orange button to start test
•Each group observes and write their considerations

Step 2 - Try Touch Sensor

•Push contact sensor
•Observe NXT display
•Describe cause effect relationships

Step 3 - Try Sound Sensor

•Keep silence, then make different rumors
•Listen to sound
•Describe cause effect relationships

Step 4 - Try Light Sensor

•Move light sensor towards light and dark objects
•Listen to sound
•Describe cause effect relationships

Step 5 Try Ultrasonic Sensor

•Move ultrasonic sensor towards and far from an object
•Listen to sound
•Describe cause effect relationships

Step 6 Let’s Write What We Discovered

•Describe cause effect relationships
•It’s not enough observing: we have to explain cause effect relationships

How to move a robot

Following the first, initial test step, participants can start to work on the movement of robot. In this, case, the icon to be used is “Move Block”, controlling the robot according to the following variables:

•Time
•Rotations
•Degrees
•Unlimited (this, depending on the sensors)

Preliminary exercises serve to learning the first three control variables. Therefore, students are asked to experiment what it is happening when they add

• 1 second
• 1 rotation
• 90 degrees

Following the experimental step, the second exercise deal with the following issue:
The robot has to walk along a 1 meter straight line.
To solve this problem, participants have to refer to knowledge in geometry, mathematics, and physics. The outcome depends on the diameter of the wheels: in fact, robot with different wheel diameters needs different data to be inserted in the program). By the diameter, we can calculate a wheel circumference, that is also, the distance walked by the robot in one wheel rotation. Thus, it is easy to calculate the number of rotations and the degrees needed to walk the given

Educational Activities

Smart city

Description

How can we make cities safer? This is the challenge for the groups of adults and young learners. Their perspective is different: more focus on the safety, on the sustainability, efficiency in transport, etc.
We suggest several areas in order to open the mind to several problems and to introduce more knowledge in the process:

•Road safety: we can use different object detection ways to avoid run over the car, for instance.
•Traffic lights, controlled by the NXT, by mechanical programmers, systems that recognizes different colours in order to allow continue to the car.
•Accessibility: design of slopes, stairs, widths. Must be taken into account in the city design.

•Orientation: choice of route, mapping interpretation.
•Security: detection and fire fighting, thefts, etc.

Time
1 hour to design the city and the activities to develop in.
2 hours to build the model. (It depends on the size, the complexity,..)
2 hours to program and to test the program.

Competences involved

Competence in knowledge and interaction with the physical world:
•Competence in learning to learn
•Competence in autonomy and personal initiative

Involving adults people

This activity involve safety, environmental and technical issues. Then, adults can guide the programming of the robots in order to resolve problems related with these values.

Subjects
Electronic, town planning and robotics.

Materials

Lego NXT Mindstorm
Wood
Adhesive tape
Model of buildings (optional)

Electromagnetic spectrum

Description

The study of wave movement in general and the electromagnetic radiation in particular is very difficult for young and older people. They notice their effects but it´s not possible to watch it directly.
We can developer activities that involve mathematic language, scientific expression of large amounts, creative construction and program skill.
Within the study of the electromagnetic spectrum, the nature of light, the wave motion.
Robot is built with a device capable of rotating a CD as desired speed. The disc may have a mark or light and dark areas. Another NXT robot will be responsible for detecting light sensor with varying light reflecting. The reflected light can be studied by DATA logging to calculate their frequency and amplitude.

Time

20 minutes for construction of the robots and 1 hour for data collection and analysis.

Competences involved

Competence in knowledge and interaction with the physical world:

•To encourage curiosity for scientific discovery.
•To increase knowledge in robotics, geology.
•To understand and to develop the scientific method.
•Competence in learning to learn.
•Competence in autonomy and personal initiative.

Involving adults people

Parents and grandparents can distrust of educational relevance of the use of robots. In this exercise we show concepts of physics in a practical way.

Subjects

Physic and robotics.

Materials

•2 Lego NXT Mindstorm with one light sensor,
•1 CD

The volcanologist robot

Description

The proposed challenge is to build a volcano model and to program the NXT with the role of an expert volcanologist that it´s investigating the environment around the volcano near its eruption.
First, the groups study the development of an eruption (earthquake, lava eruption, expelled gases from fissures or volcanic vent, soil temperature, etc.)
Secondly, they determinate the tasks of the robot (to start moving when it detects an earthquake, to approach to the volcano crater testing temperature, to remove objects from the road and to return to a safe position if the fire is very near.
Finally, to program the robot using several sensors (contact to start, light to follow a line, ultrasonic to detect an obstacle, temperature to detect a hot point or lava presence,...)
When the program is ending, we can simulate and spectacular eruption using ammonium dichromate ((NH4)2Cr2O7). If you approximate a hot cupper wire to a small amount of this substance (40g, for instance) occurs a very exothermic reaction, with emission of nitrogen gas and steam. The rest is Cr2O3 (s) with an appropriate green colour.

Time

•1 hour to preliminary study of volcano dynamic.
•2 hours to build the model. (It depends on the size, the complexity,...)
•2 hours to program and to test the program.
•15 minutes for demonstration and to simulate the eruption.

Competences involved

Competence in knowledge and interaction with the physical world:

•To encourage curiosity for scientific discovery.
•To increase knowledge in robotics, geology.
•To understand and to develop the scientific method
•Competence in learning to learn.
•Competence in autonomy and personal initiative.

Involving adults people

Adults are more interested in robotics activities when it relates to real life skills. Also is interactive activity : programming is tested and adjusted continuously.
In a heterogeneous group some members will be more interested in the physical issue, others in the construction of the model and other in programming. As a result, everyone feels useful.

Subjects

Geology, chemistry and robotics.

Materials

•Lego NXT Mindstorm with temperature sensor,
•Wood
•Plaster
•40 g ammonium dichromate ((NH4)2Cr2O7)

A robotic driving underground in the London Tube

Divide participants in groups of 3-5 (young and adults)
Each group will have to project a driving underground and move it through Picadilly Line
First step: drive forward with costant speed from Cockfosters to Finsbury Park and back to Cockfoster.

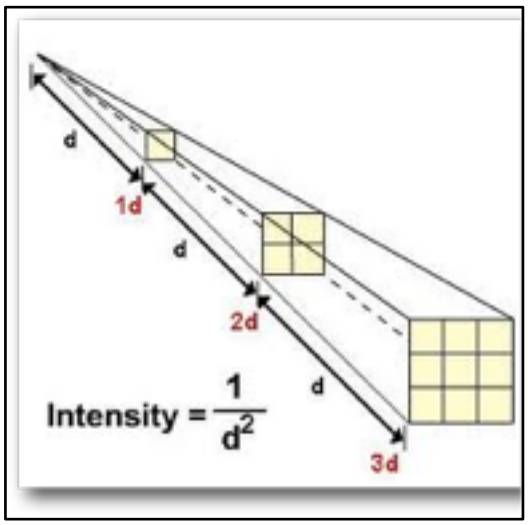
Step by Step:

•Look at the London tube map and define the right scale (from the map to the real dimensions - from real dimension to “robotic model dimension”.
•Define the time stop for each underground stop.
•Choose the model of robot you are going to use.
•Show your building steps.
•Build the robot.
•Write the program.
•Try it on the ground.
•Compile the whole project to explain your results.

•download NXT building instructions from www.nxtprograms.com/explorer/steps.html
•www.nxtprograms.com/bumper_car/steps.html
•www.nxtprograms.com/castor_bot/steps.html

Light brightness and distance

Light intensity decreases as we move away from the light source.This can easily be understood if we observe a car light: its luminosity changes if we get closer or farther. The most interesting thing is that light intensity can be measured and can be described using a mathemaical law called the inverse of the square law.



Purpose

Verify through experiments the mathematical relation between the light intensity of a light source and the distance between the light source and the light receiver.

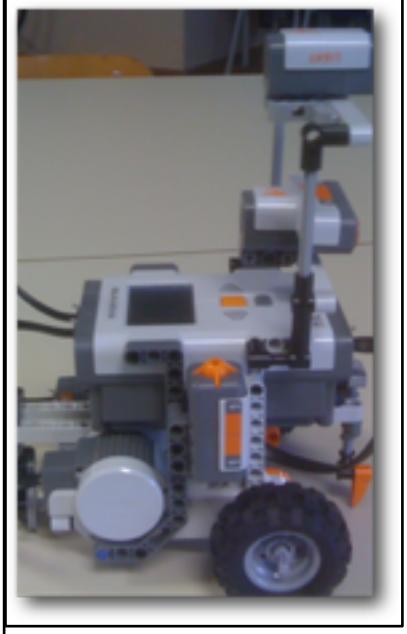
Materials

•NXT robot kit
•2 motors
•light sensor
•distance sensor
•light source
•touch sensor
•notebook
•webcam

Process

Using lego components of MINDSTORMS NXT series, we have assembled a robot able to move and measure the light intensity of a light source. In this way we have verified the

inverse of the square law. First we have realized a mobile body called “lightcar” able to move precisely along a linear path. To this prototype we have connected a light sensor, a touch sensor and an ultrasonic sensor.

LIGHTCAR	LIGHTCAR
	

Experiment 1

In this first experiement, the NTX unit has been programmed so that the robot moves around thanks to the touch sensor and gets closer and farther from the light source and registers the varying light intensity. The data are collected and desplayed on a computer screen connected to the robot and are represented on a graphic previously prepared so that it illustrates the mathematical law.

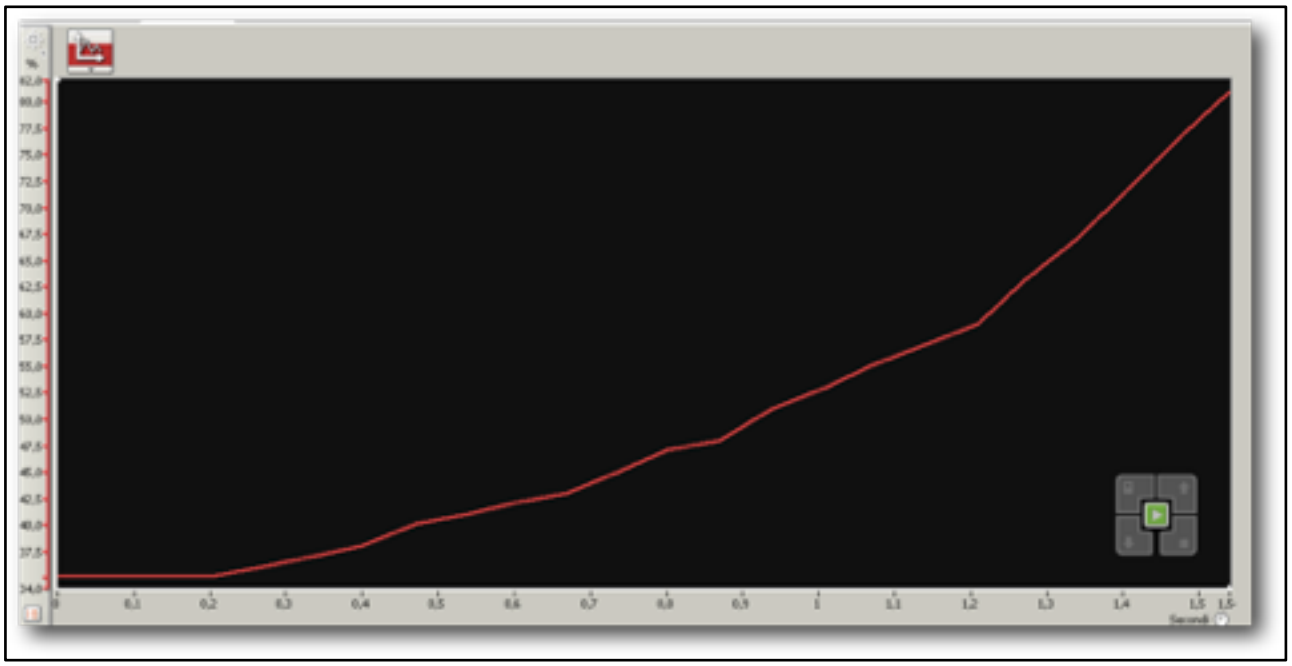
Program

The program that we have realized consists of a linear series of orders:

•motor calibration
•light sensor calibration
•motor movement at programmed speed
•light sensor activation
•recording of light sensor data referring to a certain time interval and with a certain sampling speed.

Results

Graphic line registered from the robot



Experiment 2

In this second experiment the Nxt unit has been programmed so that the robot stops after going forward for a certain programmed distance and records the light value. The data appears on the robot nxt display. When the experimenter gives a new order (touch sensor), the robot goes forward again, measures and records a new light value.

Program

In this second experiment we have also used a touch sensor and the list of orders has been slightly modified comparing to the first experiment:

•motor calibration
•light sensor calibration
•motor movement at programmed speed and at a programmed distance
•motor stop
•light sensor activation
•recording of light sensor data
•wait for touch command
•motor movement at programmed speed and at programmed distance
•recording of light sensor data
•iteration of commands up to the end of the pre-arranged path

Exoplanets research

The first discovery of extrasolar planets was made by Alexander Wolszczan in 1994 measuring the periodic variation of the arrival time of radio impulses from a pulsar, a star of neurons which represents the rests of a supernova. Most discoveries of esoplanets are the result of the investigation of the “mother star” movement. The second practical method to discover extrasolar planets is to observe the periodical obscuration of the star caused by a planet that moves in front of the star. Such phenomenon is known as planet transit around a mother star.

Purpose

Verify the mechanism of research of new planets based on the method of the planets transit.

Materials

•NXT robot kit
•light sensor
•light source
•ntx motor kit
•wooden support
•polystyrene balls
•notebook
•webcam

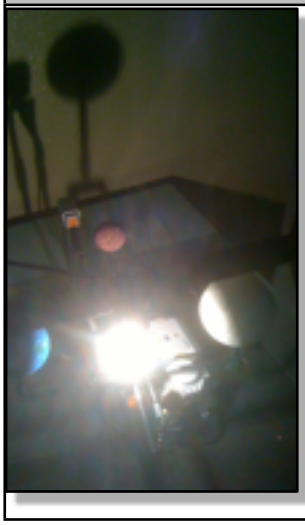
Procedure

The experiment consists of three different parts:

1. We have built a wooden structure able to host an NTX unit and a small electric plant necessary to light up a lightbulb. We have used a halogen lamp with 204 lumen to represent the extra solar star and polystyrene balls of different sizes and located at a different distance from the light source to represent the various planets.
2. We have realized a planetary system using lego components, screws, polystyrene balls and an arm on which a light sensor has been placed.
3. We have connected the planetary system to the NXT lego unit and we have programmed the lego unit so that the planetary system could move and at the same time the computer could measure the light intensity during the planets transits.

Here below please find a scheme that shows the relationships between our model and the astronomic reality simulated in the laboratory.

polystyrene balls	= esoplanets
lightbulb	= mother star
NXT motor	= planets movement
light sensor	= telescope
notebook and software	= elaboration of astromonic data

Light sensor in action	Detail of light sensor	Detail of the planetary system	Planet detail
			

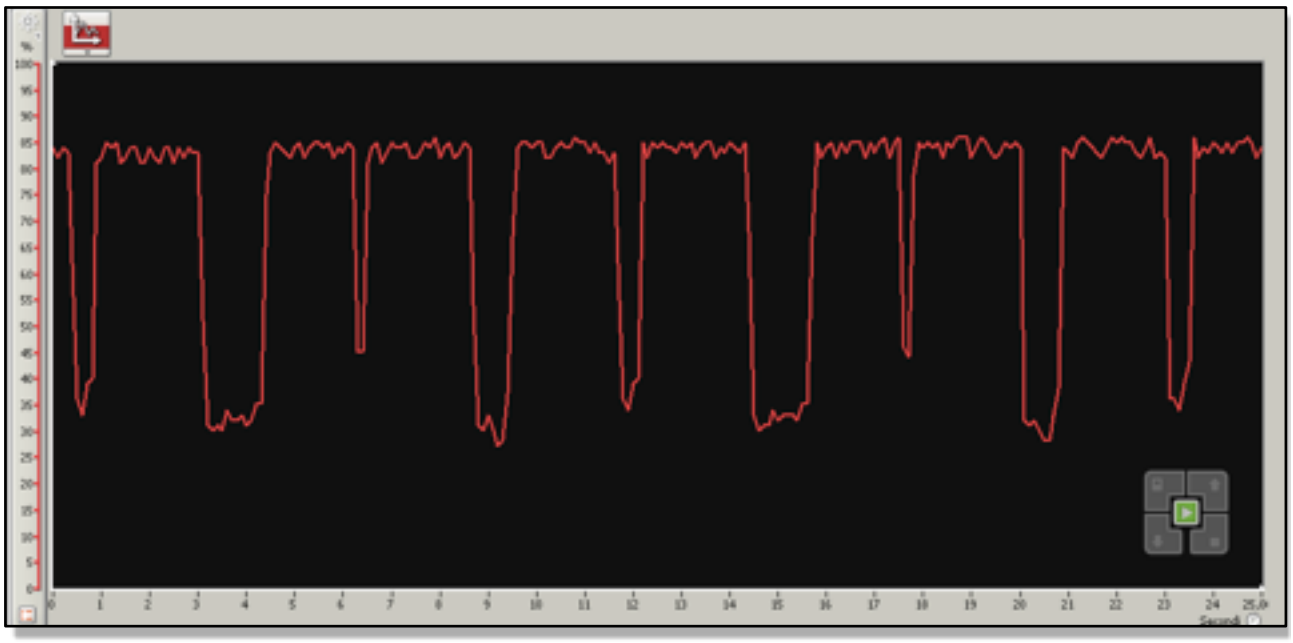
Program

The program that we have realized consists of a linear series of orders according to which the following tasks are subsequently performed:

•motor calibration
•light sensor calibration
•motor movement at programmed speed
•light sensor activation
•recording of light sensor data referring to a certain time interval and with a certain sampling
•stop of light sensor recording
•motor stop
•end of program

Results

Here is the video and the graphic line registered from the robot



Avoid the obstacle

This activity has been planned to learn how to programm the movements of a robot guided by a distance sensor.

Purpose

The robot must get close to an obstacle and once he reaches a distance of 10 cm from the same, he must stop, move around it and then pull it down.

Materials

•NXT robot kit
•distance sensor
•polystyrene base
•2 motors
•notebook
•webcam

Procedure

In this activity we have programmed the robot so that he can perform the described tasks.

Introduction to programming

This Handbook, which is one of the outcome of RobGap European Project, focuses on the use of robotics and of the iconographic programming software's applied to robots.
Throughout all the workshops and experiences carried out by our Partners in these years, we came to the conclusion that we would need a programming language much more flexible and developed than the iconic NXT-G Lego program, which was used until then in most of the classes of the RobGap project.
This demand aroused also from the fact that some of our adult participants expressed their willingness to work on a more textual program. We then decided to add to the project syllabus the free software Scratch, developed by Boston MIT.

Scratch is an educational programming language and multimedia tool that can be used by pupils, teachers, and parents for story telling activities, and a range of educational and entertainment constructivist projects from math and science projects. It includes simulations and visualizations of experiments, recording lectures with animated presentations, to social sciences animated stories, and interactive art and music. It is compatible with NXT robotics kit by Enchanting (it is a Scratch Modification that allows the programming of LEGO Mindstorms NXT robots). Scratch is also compatible with Arduino programmable breadboard through the version of Scratch for Arduino (S4A)
These two softwares allow the user to tackle more complex programming degrees, while, from an educational point of view, opens up to more easily learning of textual languages.

This Handbook – as well as the RobGap project as a whole – do not aims to only teaching the use of the free software Scratch, but aim to illustrate the educational benefits of its use.

For information and manuals about and of Scratch software:
http://download.scratch.mit.edu/ScratchGettingStartedv14.pdf

Organize a workshop to involve people (youngsters-elder people)

Step by Step we can set a Workshop to involve Yongster and ederly people.
1. Presentation of each partecipant (icebreaking), the aim of this activity is create a team.

2. Set a Topic (i.e Underwater robotics, industrial robotics, space robotics etc.):
a. Be Creative! Work on creative robotics, it is good for children and adults and join different ages.
b. Create a tale about the work, educational robotics is not only technology!
c. Speak about technical topics and young became tutors/mentors.

3. Go deep in the technical:
a. Speak about biology and environment
b. use robots to explore the environment
c. improve social competencies as ecology

4.Create a tale with video, pcitures etc
a. Create a word with a stroyboard
b. use some tools as plasticines to create a stopmotion video)

5. Each group have to show is work from technical and narrative point of view.

Each Robgap Workshop have to involve Adults and children but at the begin we can separate adults from young, becasue the gap can became an obstacle to share information.
The second step is Adult can teach to young people about their tecnical experience and after young people can share their knowledge.
At the end of the second step Adults and youngster can work together on NXT Programming.

Conclusions

All the partners of RobGap have designed, written and organized this Handbook together.
This Handbook aims at support any person teaching science&technology employing educational robotics as mobile laboratory. Another important aim is the involvement in the learning not only of young students but also of their parents and grandparents.
The many conferences, classes, demos organized in the Nations Partners of the project showed the interest raised by these events among young people and adults.
When we stared out common workshops attended by young people and adults we asked ourselves whether they could really and deeply develop the communication level needed to spark off their collaboration. And, at the conclusions of many workshops carried out in all the Partners Nations, we understood that it did happen, that in Europe young people and adults are not far from each other in terms of technological acquisitions and learning skills. More than that, they could compensate each other's knowledge and learning methodology.
Clearly, with our young students we did not develop lessons on educational methodology and learning processes we discussed with our Partner Teachers. In these occasions, we decided to split the classes in two lessons, and then all the students/adults re-united when we saw that there was a knowledge homogeneity .
In fact, for our adults, it was precisely to see your young students' enthusiasm and excitement that was key in speeding up the former learning will and passion.
Another among the goals we intended to obtain with this Handbook is to reach the highest possible number of European teachers, so that they could, in future, organize their own "RobGap classes in their school, communities, hangouts.
Our hopes is that this Handbook marks only the beginning of a long and rich process where European students and adults could share knowledge in science and technology and where different generations hand down each other their skills.