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# MAKER EDUCATION

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# MAKER EDUCATION

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**Project Title: Maker Education**

**Main objective of the project: Exchange of Good Practices**

**Project Start Date: 01-09-2019**

**Project End Date: 31-08-2021**

**Project Total Duration: 24 months**

**Applicant Organisation: Colegiul Tehnic „Gheorghe Cartianu”,  
România**

**Website: <https://makereducation6.weebly.com/>**

**Partner Organisations:**

- **SABA, The Republic of North Macedonia, partner**
- **Insignare - Associacao De Ensino E Formacao, Portugal, partner**
- **Erbakir Fen Lisesi, Turkey, partner**
- **Iis Alessandro Volta, Italy, partner**
- **Centrum Kształcenia Praktycznego w Jastrzebiu-Zdroju, Poland, partner**



**1.LEGO Education Solution**  
**Short-term exchanges of groups of pupils**  
**4<sup>th</sup>-8th October 2021**

*Erbakir Fen Lisesi, Denizli-Turkey*

Project title: Maker Education

Project reference number: 2019-1-RO01-KA229-063086\_5

Days	Activity
3 October 2021	Arrival
<b>October 4-2021</b>	
9.00-	Welcome Coffee, signing list of participants. Opening
10.00-	– Presentation of the school. Gastronomy festival -Each school will present the preparation of a traditional food (sweets, cakes) from its own country -Participants will taste traditional products specific to each country. -Presentations about school and country. Turkey, Romania, Poland, The Republic of North Macedonia, Portugal, Italy
12:00 -	Lunch
13.00-17.00	Guided Visit to Pamukkale Free time for students in Leman Kültür Cafe
Free Time, visit the city.	
<b>October 5, 2021</b>	
9.00-11.30	Day 2 – LEGO® Education Solutions 1.Strategy workshop -LEGO Serious Play for Entrepreneurship; Generating business ideas through creative techniques. Serious LEGO Play for prototyping the business idea. We will use a variety

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<b>Days</b>	<b>Activity</b>
	of LEGO kits. LEGO Education Simple & Powered Machines Teachers will go to Buldan (textile village)
12:00	Lunch for students at school Teachers will have lunch at a traditional kebab restaurant
13.00-17.00	Visiting Pamukkale Tecnokent which is an organized research and business center that integrates academic, economic and social structure and having lecture from dedicated people
Free time	
<b>October 6, 2021</b>	
6.00-13.00	Pick up from the hotel for a day trip to Ephesus –Sirince-Kusadası Lunch in Ortaklar
18:00	Dinner in Kuşadası
19:00	Departure
<b>October 7, 2021</b>	
10:00-	LEGO® Education Solutions – LEGO MINDSTORMS EV3 Teachers will go to Turkish delight factory
12.00-14.00	Lunch
14.00 17.00 20:30	Visit Denizli town centre Free time till dinner Farewell dinner in Leman hotel
Free time	
<b>October 8, 2021</b>	
9.00-	Closure
11:00	Evaluation meeting with teachers
12.00	Feedback questionnaires.
12:30	Lunch
14.00-	Free time for shopping
9 October 2021	Departure

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### *Day 1 – October 4, 2021 - Day of Intercultural Dialogue*

-Presentation of the participating high schools:

- \* “Gheorghe Cartianu” Technical College, Romania, coordinator
- \* Erbakir Fen Lisesi, Turkey, partner
- \* SABA, The Republic of North Macedonia, partner
- \* Insignare - Associacao De Ensino E Formacao, Portugal, partner
- \* Centrum Kształcenia Praktycznego in Jastrzebiu-Zdroju, Poland, partner

- Gastronomic festival - culinary art, a messenger of culture

- Pamukkale Cotton Castle and the ancient city of Hierapolis. Here you will find several natural pools with thermal water, rich in calcium carbonate. As the thermal water comes to the surface, the calcium carbonate becomes more solid and thus forms the famous white terraces. Since 1988, Pamukkale, together with the ancient city of Hierapolis in the same region, has been on the UNESCO World Heritage List and belongs to both cultural and natural heritage.



### *October 5, 2021 - Creativity Day in robotics and art*

- \* Student activity - strategy workshop, generation of business ideas through creative techniques for entrepreneurship with the help of robotics kits - LEGO MINDSTORMS EV3.
- \* Teacher activity - creative workshop at the Directorate of the Public Education Center Denizli Merkezefendi
- \* Visiting the city of Denizli.

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*October 6, 2021, Day of Cultural Discoveries, trip to Ephesus-Sirince-Kusadası*

1. House of the Virgin Mary - Mother of Jesus
2. Ephesus - UNESCO World Heritage Center
3. Sirince village
4. Visiting the city of Kuşadası



*October 7, 2021, Digital Education Day*

\* Student activity - software programming of robots built using LEGO MINDSTORMS EV3 kits

Teachers activity - official visit to the National Education Directorate of Denizli Province (DENİZLİ İL MİLLÎ EĞİTİM MÜDÜRLÜĞÜ), presentation of the educational system in Denizli

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\* Visiting the Pamukkale Teknokent Center - 3D modeling, games and mobile applications: <https://www.tgbd.org.tr/pamukkale-teknokent-firmasi-236>



*October 8, 2021 - The closing ceremony of the mobility*

Following the exchange of experience, all of us, students and teachers, have developed our professional and personal skills!

We thank our hosts for their special involvement in carrying out the activities!

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## 2. European Researchers' Night 2021

*Gabriela-Brândușa Horlescu, teacher  
Șalaru Constanța, teacher  
“Gheorghe Cartianu” Technical College*

It's September 24, 2021, starting with 17:00, “Gheorghe Cartianu” Technical College hosted the most captivating event of the autumn: the Night of European Researchers! The most friendly researchers waited there, with whom I was on a fascinating journey into the world of science.

And the good news doesn't end there. On September 25, 2021, between 12:00 and 20:00, were presented online, on our Facebook page, the most interesting workshops of researchers from all cities participating in the Night of European Researchers Romania. Visitors had the opportunity to see the most amazing experiments, learn about new inventions and were able to find inspiration by interacting with researchers from all over the country.



Learn, have fun and feel inspired! In addition to the exhibition of Electronics and Robotics that presented products and experiments made within the project – coordinators: teacher Gabriela-Brândușa Horlescu, teacher Șalaru Constanța, teacher Ana-Irina Secară, teacher Carmen Simona Stanciu.

**EVENT AGENDA** Be a researcher for a day!

The European Researchers' Night was a journey into the world of science and technology with our college team. Through practical applications in electronics, robotics, mechanics, computer science and environmental protection, they experienced together the fascinating world of science.

The activity carried out within the school's Erasmus + projects was presented, as well as the achievements of the students from the Electronics and Robotics group within the Neamț County Center of Excellence. The following thematic workshops took place during the event:

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✓ Recycling of metal waste by plasma cutting, a workshop that demonstrated to the public how we can creatively reuse metal waste, finding a new use. This avoids energy consumption to make the new product and to return the old product to the raw material stage.

✓ Recycling plastic waste - because plastic is very difficult to integrate into nature, we must find solutions to keep it in industrial and domestic circulation for as long as possible, so the workshop presents some creative ideas for reuse (repurposing) waste plastic.

✓ Presentation of high school Erasmus + projects (Creative Opinions Differentiated Education In Maths, Maker Education, Technology - Addiction and Internet Dependency Syndrome, Future Language is Robotic Coding, VOCATIONAL-WEB-LEAP: An Open Source e-Learning Platform for Training Vocational Students, Apprentices and Graduates on Web Design and Development.

✓ Gheorghe Cartianu Technical College seen from the drone

✓ Lego Mindstorm EV3 - Robot that follows a line

✓ Lego Mindstorm EV3 - Ball throwing robot

✓ Lego Mindstorm EV3 - Dancing robot

✓ Micro: bit

The applications made with the help of Lego Mindstorm EV3 kits were made within the Maker Education project.

<https://www.facebook.com/NoapteaCercetatorilorEuropeni/>

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**2.1. Creative recycling of metallic waste by plasma-cutting**  
**Presentation on-line by students Stroia Gabriel and Sava Robert for researchers**  
**night 2021**

*Eleonora Dragomir, teacher*  
*“Gheorghe Cartianu” Technical College*



Waste is not only an environmental problem, but also an economic loss. On average, Europeans produce 481 kilograms of municipal waste per year.

The amount of waste we generate is closely linked to our consumption and production patterns. The very large number of products entering the market is another challenge. Demographic changes, such as the increase in the number of single-person households, also affect the amount of waste we generate (for example, the packaging of products in smaller packages).

The wide range of types of waste and complex waste treatment routes (including illegal ones) make it difficult to get a complete picture of the waste generated and where it is located.

According to data for 2019 for 29 European countries (ie EU 28 and Norway), about 60% of the waste generated was mineral and soil waste, largely due to construction and demolition activities and mining. With regard to scrap metal, paper and board, wood, chemical and medical waste and animal and vegetable waste, each type of waste accounted for between 2% and 4% of the total.

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About 10% of all waste generated in Europe is what is called "municipal waste" - waste generated mainly by households and, to a lesser extent, by small businesses and public buildings such as schools and hospitals.

An increasing part of this amount is recycled or turned into compost, while a smaller part ends up in landfills.

Metal waste holds a percentage of 2% of the total amount of waste but the waste of energy is much higher because the production of metals is done with an energy consumption 10 times higher than for any other material.

How can we change this situation so that we produce less and less waste while using all waste as a resource?

Well, we need to creatively reuse waste, that is, not throw away what's left after using a product, but find a new use for it. In this way we avoid energy consumption to make the new product and to bring the old product back to the raw material stage.

Regarding metal waste, an effective solution for its reuse for new purposes without the need for remelting is thermal cutting.

We chose plasma cutting as a thermal cutting process because it is the most economical process in terms of material and energy consumption.

Plasma cutting was invented by researchers at Union Carbide, the Linde division.

The plasma arc cutting process materialized when scientists were able to direct the electric arc formed between a tungsten electrode and the cutting part to increase the energy density, forming a stronger cutting arc than the welding arc and more concentrated.

The current construction of the cutting gun does not differ significantly from the first model of the 50's but many changes were needed that optimized its operation and made the work of the operator easier.

Plasma is actually an ionized gas that is a good conductor of electricity with a high temperature. It contains positively and negatively charged particles, as well as neutral atoms and molecules. Plasma is a quasi-neutral physical system (or body) from an electrical point of view, its composition includes positive, negative, neutral particles and photons. Positive particles are always atomic or molecular ions, and negative particles are usually electrons. Negative ions, formed by attaching electrons to atoms or molecules, are less common and of secondary importance. Neutral particles are atoms or molecules that can either be in a ground state (equilibrium) or are in different excited states. To produce plasma, ie to ionize the gas, it is necessary to heat the gas to a high temperature with the help of a heat source or an electric field is needed. Plasma cutting is a thermal cutting process in which a directed electric arc is used.

There are two options:

- plasma jet cutting, when the electric arc is made inside the gun and is thrown towards the piece by the blow of a gas

- plasma arc cutting when the electric arc is between the tungsten electrode inside the gun and the surface of the cutting part. The work piece to be cut and conducting the electric

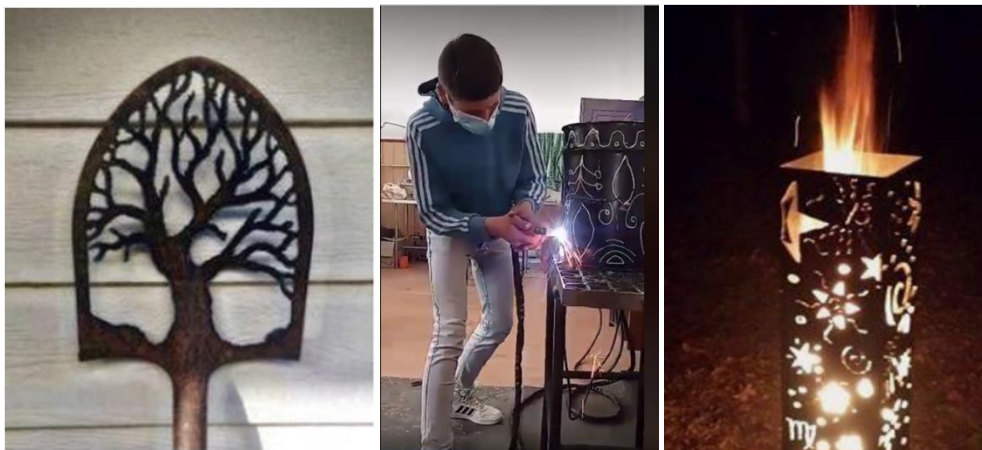
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current is connected to the negative pole of the current source (anode). The energy required to melt the work piece is provided on the one hand by the plasma jet and on the other hand by the electric arc. Under the influence of the electric arc, the plasma gases decompose and ionize partially, becoming conductors of electricity. The plasma jet has a high energy density and a very high temperature, so it goes at a much higher speed than the sound to the work piece. When the plasma arc touches the surface of the work piece, the energy stored in the spring is released and melts the work piece. This technology can be used to cut thick plates of steel and aluminum alloys up to a thickness of 160 mm.

The popularity of this technology is primarily due to the profitability of cutting. Mechanized cutting can take place at a high speed (even 9 m / min) and does not require preheating. However, in the case of thin plates with small holes or in the case of exact contours, the laser may be a more advantageous solution, but this happens very rarely. For example, in the case of steels with a thickness of more than 3 mm, plasma cutting is cheaper, and in the case of aluminum or alloy steel plates with a thickness of more than 8 mm, the costs can be even five times lower if the cutting takes place with plasma.

We have developed a project to use plasma cutting to make garden decorations from scrap metal. We can use as raw material empty boxes of paint or buds, plates from bodies or boxes of broken appliances. Plasma cutting is possible even if the material is painted, rusted or enameled.



These newly produced objects would also be useful because they will stand the temperatures of a fire that could be achieved inside them and by the fact that they can withstand frost if they were filled with earth.

The best cutting quality and the longest service life are usually obtained at an amperage set at 95% of the nozzle rating. If the amperage is too low, the cut will be inappropriate. If the amperage is too high, the nozzle service life will be affected. Proper gun assembly is also important for quality cutting. Assemble the gun so that the parts are properly aligned and firmly fixed. This ensures good electrical contact and the correct flow of gas and coolant through the gun. When changing consumables, place them on a clean cloth to prevent dust or

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metal from entering the gun. Cleaning during gun assembly is very important and often neglected. When we lubricate the O-ring, we use a small amount of lubricant, a larger amount of lubricant can cause clogging and penetration of metal dust into the gun, leading to an uncontrolled arc in the plasma chamber and eventually damage to the gun. We should never use Vaseline. This destroys the bow and burns inside the gun.

Here is an application of the “Little Prince” method, the compositional variant in practicing the students' abilities to prime the electric arc.



These are students' works representing a story in each wasted box .



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## 2.2. Creative recycling of plastic waste

### On-line presentation by student Leonte Alexandru

*Eleonora Dragomir, teacher*  
*“Gheorghe Cartianu” Technical College*



Together we can fight plastic pollution. Clear decisions and urgent measures from both the manufacturing companies and the authorities are absolutely necessary, changes that focus on the health of the environment and people!

Here are some creative ideas for reusing for new purposes (repurposing) the plastic waste that we tried together with the students, taking advantage of the long time spent at home during the lock-down period.

Below are some inedited household items obtained by cold cutting plastic bottles and drums created individually by students during online school



Eco Christmas tree, created by Mrs. Dragomir Eleonora together with the students from „Centrul Școlar de Educație Incluzivă Alexandru Roșca”.

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Useful objects made through hot drilling and cutting followed by assembling made by students.



Brain new constructions material made from PET bottles

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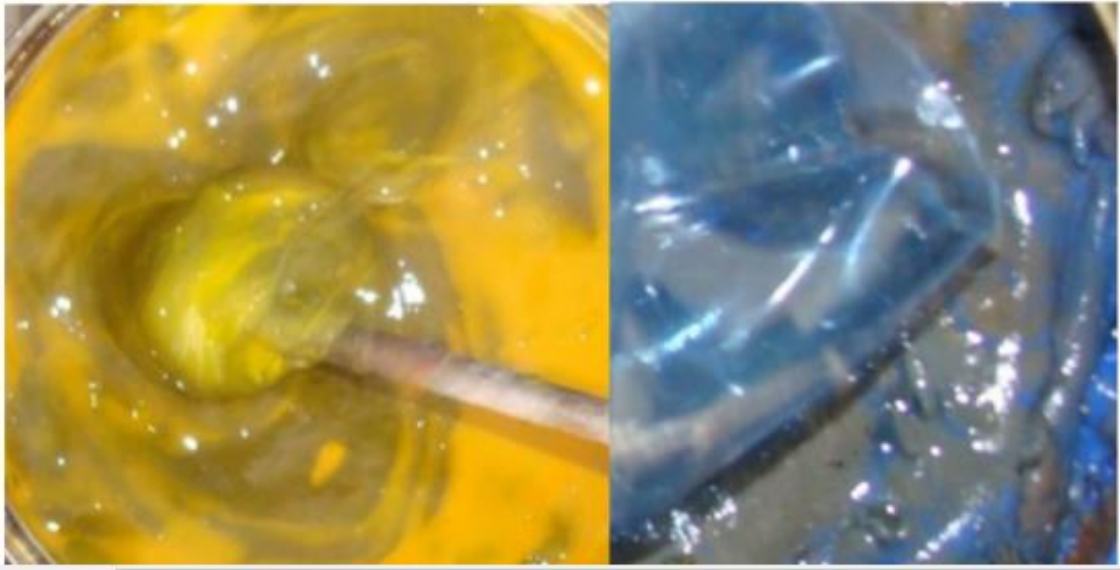


It is presented an original method of producing an absolutely new decorative building material by melting and coloring with oil colors the polyethylene terephthalate bottles.

The process is a variant under study of the polyethylene terephthalate composite material patented by the Gheorghe Cartianu Technical College (patent no. 123372) in which the students worked during a special program for training young entrepreneurs in rural areas together with Mrs. Eleonora Dragomir.

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### 3.Arduino experiments

*Şalaru Constanţa, teacher  
“Gheorghe Cartianu” Technical College*

Arduino is a microcontroller development board, very popular and easy to use, with which we can create our own projects.

Consisting of a simple hardware platform and a free source code editor, Arduino is designed to be used by both inexperienced and advanced users with complex and ambitious projects.

The hardware component consists of an 8, 16 or 32-bit Atmel AVR microcontroller, with complementary components that allow programming and incorporation into other circuits.



The software component provides an integrated development environment (IDE). A program written in IDE for Arduino is called a sketch. Arduino IDE supports C and C ++ programming languages.

Arduino can be used for robots, home automation gadgets, car projects, detection and control lights, interactive objects - such as animated sculptures, toys and games, and in many other projects.

The Arduino UNO board connects to the USB port of the computer using a USB A-B cable, available in 1.5 meters or 3 meters. It can be powered externally (from the socket) using an external power supply. External power supply is required if the consumers connected to the board require a current higher than a few hundred milliamps.

Otherwise, the card can be powered directly from the PC via the USB cable. The package contains only the Arduino board, and not the USB cable or the external power supply (it is necessary to order them separately, if you want).

Specifications:

- Microcontroller: ATmega328
- Working voltage: 5V
- Input voltage (recommended): 7-12V

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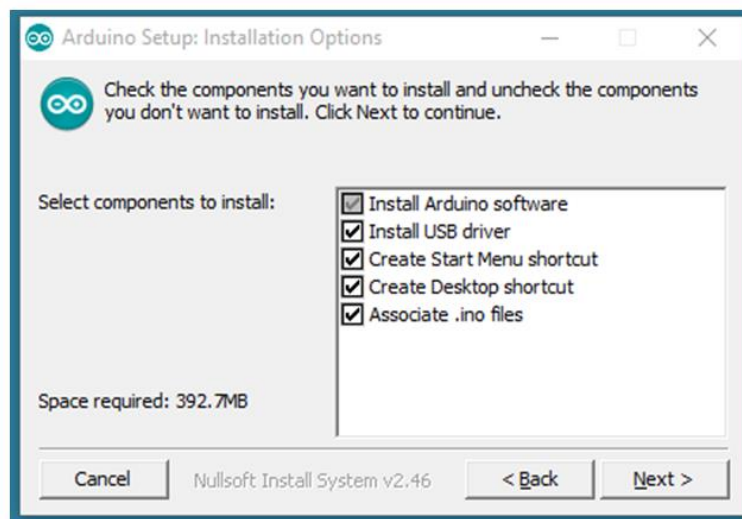
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- Input voltage (limit): 6-20V
- Digital pins: 14 (6 PWM output)
- Analog pins: 6
- Current per I / O pin: 40 mA
- 3.3V current: 50 mA
- Flash memory: 32 KB (ATmega328) 0.5 KB for bootloader
- SRAM: 2 KB (ATmega328)
- EEPROM: 1 KB (ATmega328)
- Clock Speed: 16 MHz

### ***Installing Arduino***

Get the latest version from the download page. We can choose between the Installer (.exe) and Zip packages. Suggest; use the package (.exe) that directly installs everything it is need to use the Arduino software (IDE), including the drivers. With the Zip package we have to install the drivers manually. However, the Zip package is useful if you want to create a portable installation.

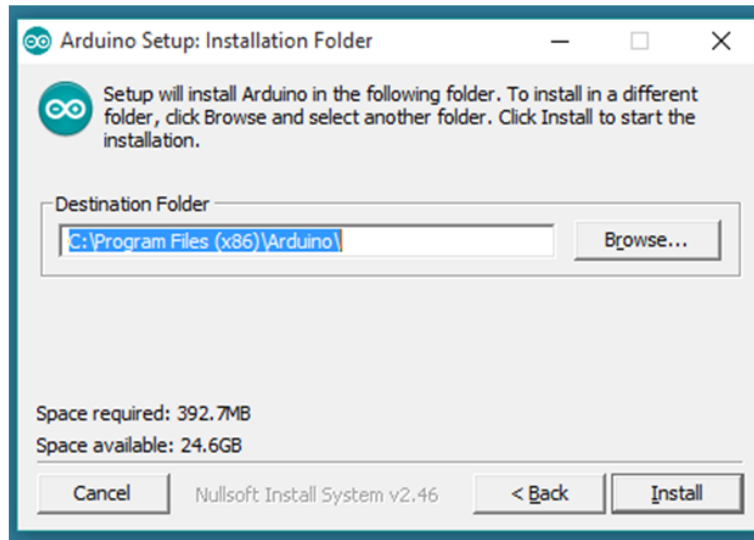
After the download is complete, continue with the installation and allow the driver to install when we receive a warning from the operating system.



Choose the components what we want installed.

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The process will extract and install the files needed for the proper execution of the Arduino software (IDE).

### *Sensors*

The sensor is a technical device that reacts qualitatively or quantitatively through own measurable quantities, to certain physical or chemical properties of the environment in around him. As a component part of a device or detector technical system can measure / record for example pressure, humidity, magnetic field, acceleration, force, sound intensity, radiation, etc. It comes from Latin: sensus = sense.

A sensor is a device that measures a physical quantity (mass, pressure, temperature, humidity, etc.) and turns it into a signal that can be read by an observer through an instrument or can be processed.

There are several classifications. One of it's refers to type of sensors:

- 1.Active: energy consumer, eg. radar (distance measurement by emission of electromagnetic radiation)
- 2.Passive: for example photo resistance with which light intensity can be measured incident.

In automation, measurable qualitative/quantitative information delivered by sensors, after a possible amplification and processing it serves to control and regulate the systems automatic techniques.

### *Sensor categories*

The most common sensors that a smartphone can contain can be framed in three broad categories: motion sensors, environmental sensors and position sensors.

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### *Movement sensors*

The first category contains sensors specialized in measuring both accelerations and those three physical axes as well as on the measurement of the rotations around the respective axes. These are called movement sensors. Are included in this category: accelerometer sensors gravity sensors, gyroscopes and rotation vector sensors.

### *Environmental sensors*

Environmental parameters are measured using environmental sensors.

This category of sensors measures the temperature and pressure of the ambient air, the humidity and lighting of the environment in which we find ourselves. Sensors of this type are: thermometers, barometers and photometers.

### *Position sensors*

Position sensors are used to measure the physical position of the device. In the this category includes orientation sensors and magnetometers.

Another categorization of the sensors can be done after the physical existence. This way the sensors can group in hardware sensors and software sensors.

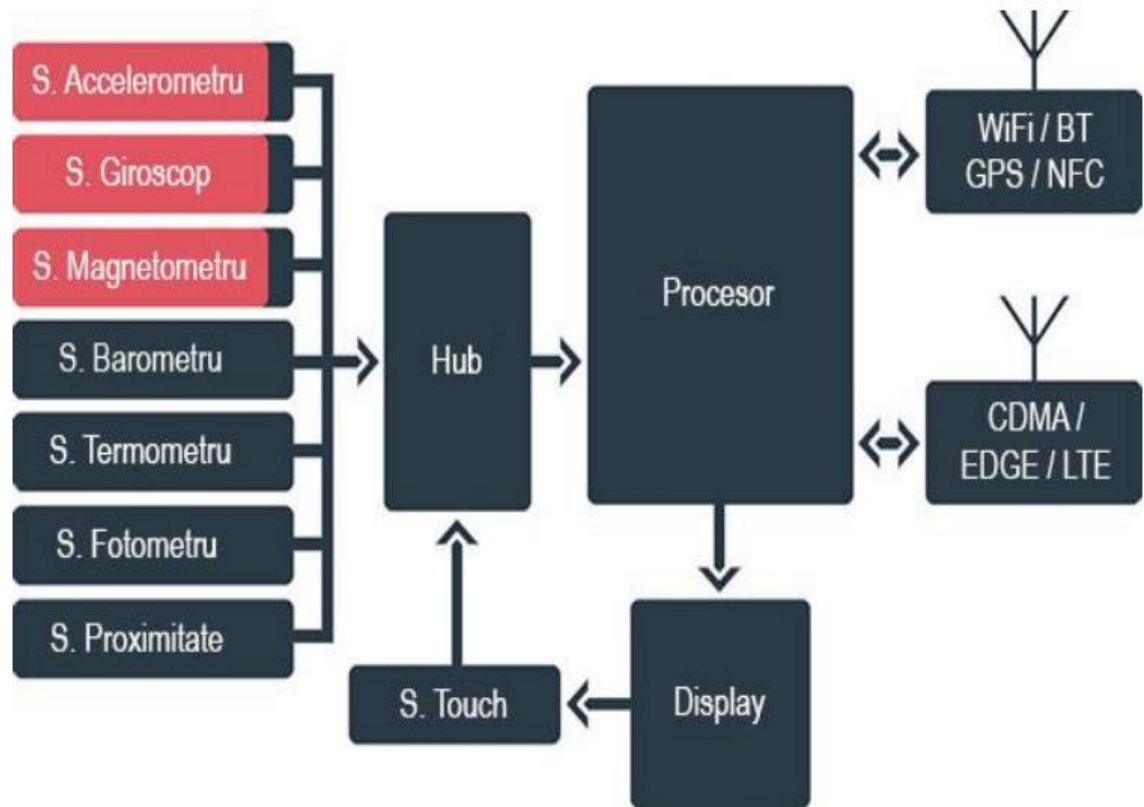
### *Hardware sensors*

When we are dealing directly with physical sensors, actually mounted on motherboard, we say we own and use hardware sensors. Measurements are made directly by the sensor and are also transmitted directly. These sensors measure for example acceleration, geomagnetic field strength and angular variations.

### *Software sensors*

Unlike hardware, software sensors do not physically exist on the motherboard and I can't physically take measurements. These are also called virtual sensors or sensors synthetic. Software sensors can combine measurements received from one or more hardware sensors. Examples of software sensors: linear acceleration sensor, sensor gravity etc.

Not all of these sensors are mandatory in every smartphone. Some are more popular and are mounted in almost every smartphone (accelerometer, magnetometer), sometimes even two of the same type, while others are not needed or are considered another luxury (thermometer, barometer).



### Types of sensors

- Hardware Accelerometer Sensor (Hardware) - measures the applied acceleration device on all 3 physical axes, including gravity.
- Ambient Temperature Sensor (Hardware) - measures temperature ambient temperature in the room.
- Gravity sensor (Software or Hardware) - measures the applied gravity device on all 3 physical axes.
- Gyroscope sensor (Hardware) - measures the rotation rate around the 3 axes physical.
- Light Sensor (Hardware) - measures the level of ambient light.
- Linear Acceleration Sensor (Software or Hardware) - measures acceleration applied to the device on all 3 physical axes, excluding gravity.
- Magnetic field sensor (Hardware) - measures the ambient geomagnetic field for all 3 physical axes.
- Orientation sensor (Software) - measures the rotation of the device around the 3 physical axes.
- Pressure sensor (Hardware) - measures the ambient air pressure.

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- Proximity sensor (Hardware) - measures the relative proximity of an object to the device screen.
- Relative Humidity Sensor (Hardware) - measures relative humidity environmental.
- Rotation Vector sensor (Software or Hardware) - measures orientation device using 3 rotation vectors.
- Hardware sensor - measures the temperature of the device

### Temperature

Temperature is a physical quantity of a system that expresses whether the system respectively it is warmer or colder. Thus, the material with a higher temperature is warmer, and the one with a lower temperature colder. It indicates the speed at which atoms what make up a moving substance, in the case of heating their speed increases. Scientists states that at an extremely low temperature, called absolute zero, atoms or molecules would stop moving completely. Temperature along with light are part of the factors ecological.

Temperature is a fundamental state parameter that characterizes the state thermal of a body, more precisely, the state of thermodynamic equilibrium. Conditions of the state of thermodynamic equilibrium are expressed by the two postulates of thermodynamics:

*The first postulate*, also called the general principle of thermodynamics, refers to the fact that the isolated system always reaches a state of equilibrium after a period of time thermodynamic and cannot come out of this state on its own: According to this postulated, if an isolated system is taken out of the thermodynamic equilibrium state, it will return to steady state conditions after a period of time, called relaxation time.

*The second postulate*, also called the zero principle of thermodynamics, specifies the properties system in a state of thermodynamic equilibrium, by two equivalent formulations:

- Any size of a system in thermodynamic equilibrium can be determined depending on the external state parameters of the system and a size which characterizes the internal state of the system, called temperature
- Two thermodynamic systems in thermal equilibrium with a third system, find a balance between its.

### *Empirical temperature*

Experimentally it is found that if two thermodynamic systems A and B are put in thermal contact (heat exchange is possible between them) then the systems either remain further in the initial thermodynamic equilibrium state, or the equilibrium states of systems are disturbed, and after a certain time, following heat exchange, its establishes another state of thermodynamic equilibrium for systems A and B. If we put then the composite system (A+B) in thermal contact with a third system C, whether equilibrium established between systems A and B does not change, whether this balance is disturbed even after for a time all three systems pass into a new state of thermodynamic equilibrium. Thus, the transitivity property of the thermodynamic equilibrium is highlighted.

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The thermodynamic equilibrium state of a system is determined by external parameters and of a quantity  $\theta$  called empirical temperature, which characterizes the internal state of the system. Temperature is said to be a state parameter of the system. The temperature is a scalar size.

The empirical equilibrium temperature is the same for all systems in thermal contact and remains unchanged after the thermal contact is interrupted. Property of transitivity of the thermal equilibrium allows the comparison of the values of the parameter  $\theta$  for different systems using another body as an intermediary. Therefore, if two systems put in contact does not change its initial thermodynamic states, the two systems are characterized by the same empirical temperature  $\theta$ , and if the initial states change, then the two bodies have different empirical temperatures.

*Measurement units*

The unit of measurement in the International System (SI) is the kelvin (K).

The temperature 0 K is the so-called absolute zero and is the point in which molecules and atoms have the lowest thermal energy. Usually two are used temperature scales, the Celsius scale, especially in European countries and the Fahrenheit scale, in United States. These are defined by the Kelvin scale which is the scale fundamental temperature in science and technology.

A degree Celsius represents the 1 / 273.16 part of the interval between the point triple the water (0.01 ° C) and the absolute zero point (-273.15 ° C) at normal pressure.

Conversion ratio:

$$T(^{\circ}\text{C}) = T(\text{K}) - 273,15$$

$$T(^{\circ}\text{F}) = 9/5 T(\text{K}) - 459,6$$

Celsius	Fahrenheit	$^{\circ}\text{F} = ^{\circ}\text{C} \times 1.8 + 32$
Fahrenheit	Celsius	$^{\circ}\text{C} = (^{\circ}\text{F} - 32) / 1.8$
Celsius	Kelvin	$\text{K} = ^{\circ}\text{C} + 273.15$
Kelvin	Celsius	$^{\circ}\text{C} = \text{K} - 273.15$

Humidity

Humidity is the amount of water vapor contained in a sample of air. There are three ways to express humidity: absolute humidity, humidity relative and specific humidity.

Absolute humidity is the amount of water vapor (in grams) contained in a volume of air equal to unity.

Relative humidity (abbreviated RH) is the ratio of the partial pressure of water vapor under the given conditions and the partial vapor pressure under the conditions of equilibrium at the same temperature. Relative humidity depends on temperature and pressure.

---

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### Humidity measurement

There are various devices used to measure humidity.

The hygrometer is an instrument for measuring air humidity. The principle of hygrometer operation is based on changing the length of a hair in function of humidity.

The psychrometer is a device used in meteorology to measure content of water vapor in the air. The psychrometer consists of two thermometers: a thermometer dry and wet, with a fan. Depending on the temperature difference between the two thermometers and atmospheric pressure, the humidity is determined with using diagrams or psychrometric tables.

### *Condensation in homes*

Condensation occurs in a home due to too much humidity in the indoor air.

The main factors that influence the appearance of condensation are:

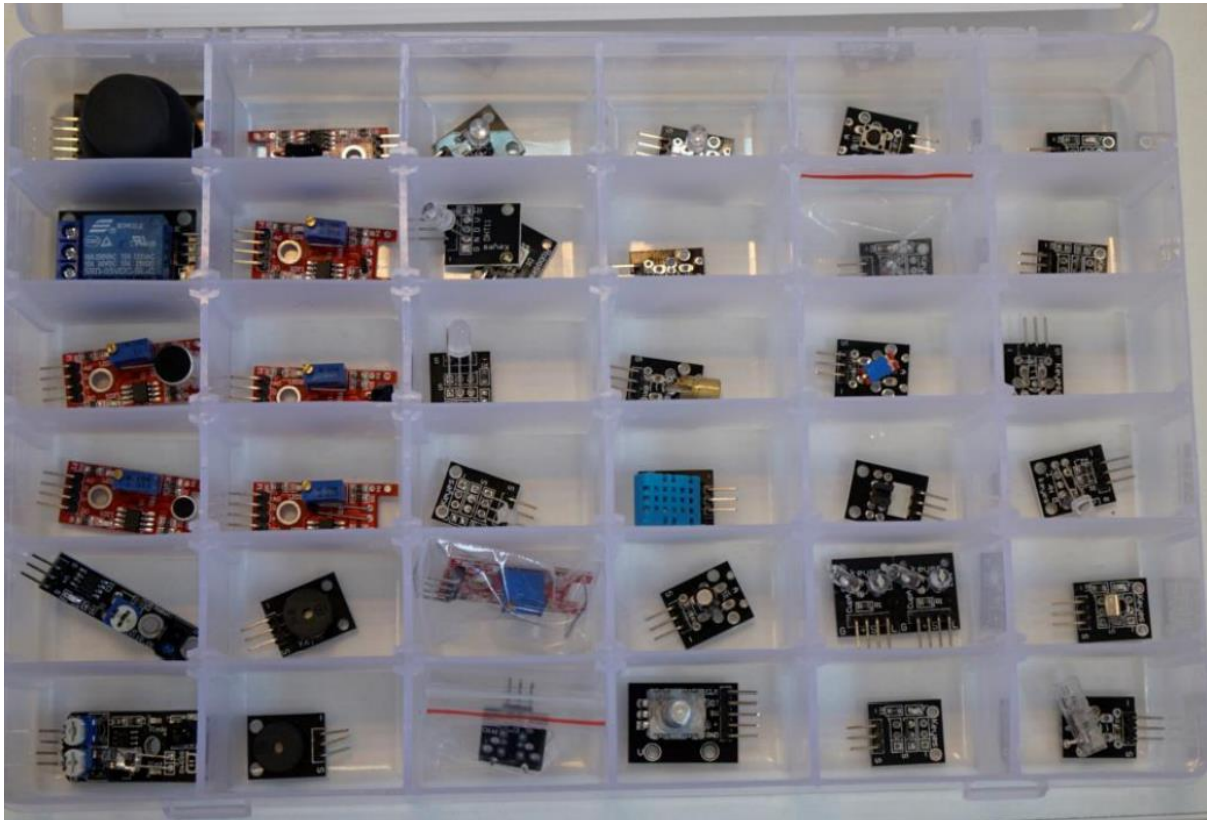
- indoor air temperature;
- wall temperature;
- the amount of vapor in the air.

Condensation occurs in the home, especially in winter, because the temperature of the walls is low and the amount of vapor in the air is high.

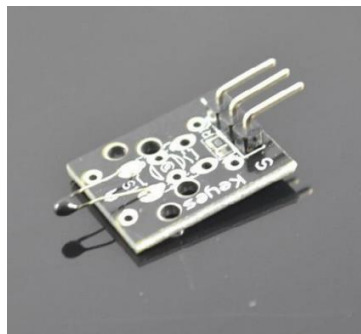
The amount of water vapor that can be retained in the air depends on its temperature. The lower the air temperature, the more it can hold a quantity lower water vapor. Excess vapor that cannot be absorbed and retained in the air.

The housing is deposited on the colder interior elements in the form of drops called condensation.

## Arduino Sensors



### Analog temperature sensor



The KY-013 Arduino module is based on the thermistor (resistance increases with ambient temperature changes), in real time.

To know the temperature of the environment, we will send the data the Arduino analog IO. The programming will be able to convert the output data of the sensor in temperature values measured in degrees Celsius and displays its, being easy to use. It is effective, so are widely used in gardening, home alarm systems and other devices.

#### Specifications

- Operating voltage - 5V

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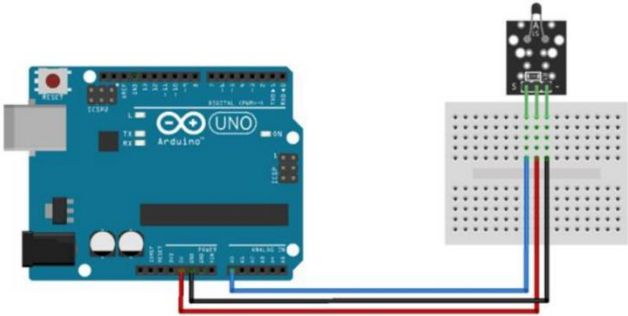
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- Temperature measuring range > -55 ° C to 125 ° C [-67 ° F to 257 ° F]
- Measurement accuracy: ± 0.5 ° C

Wiring diagram

Connect the panel (middle) and ground (-) power line to 5V and respectively GND. Connect the signal (S) to pin A0 on the Arduino.

- S A0
- middle 5V
- GND

	<pre>int ThermistorPin = A0; int Vo; float R1 = 10000; float logR2, R2, T; float c1 = 0.001129148, c2 = 0.000234125, c3 = 0.0000000876741; void setup() {   Serial.begin(9600); } void loop() {   Vo = analogRead(ThermistorPin);   R2 = R1 * (1023.0 / (float)Vo - 1.0);   T = (1.0 / (c1 + c2*logR2 + c3*logR2*logR2*logR2));   T = (T * 9.0) / 5.0 + 32.0;   Serial.print("Temperature: ");   Serial.print(T);   Serial.println(" C");   delay(500); }</pre>
---	---

Analog and digital temperature sensor KY-028



Digital temperature sensor KY-028 for Arduino, measures the changes of temperature based on thermistor resistance. This module has both digital and analog, there is a potentiometer that adjusts the detection threshold on the digital interface.

KY-028 Specifications KY-028 consists of an NTC thermistor, a comparator dual differential LM393, a 3296W cutting potentiometer, six resistors and two Indicator LEDs. The board has an analog and digital output.

---

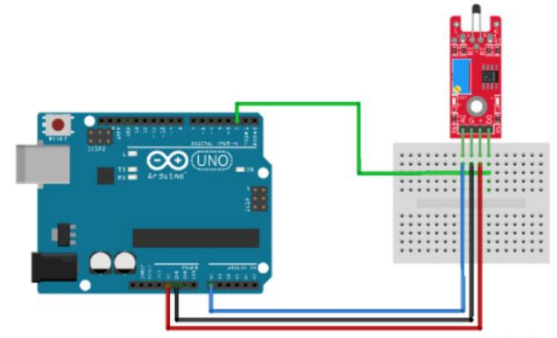
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- Operating voltage from 3.3V to 5.5V
- Temperature measuring range -55 ° C to 125 ° C [-67 ° F to 257 ° F]
- Measurement accuracy  $\pm 0.5$  ° C
- Board dimensions 15mm x 36mm [0.6in x 1.4in]

Connection diagram KY-028

Connect the analog board output (A0) to pin A0 on the Arduino and the digital output (D0) to pin 3. Connect the power line (+) and ground (G) to 5V and GND, respectively.

KY-028	Arduino
A0	A0
G	GND
+	5V
D0	2



```

int led = 13;
int digitalPin = 2;
int analogPin = A0;
int digitalVal;
int analogVal;

void setup()
{
  pinMode(led, OUTPUT);
  pinMode(digitalPin, INPUT);
  pinMode(analogPin, OUTPUT);
  Serial.begin(9600);
}

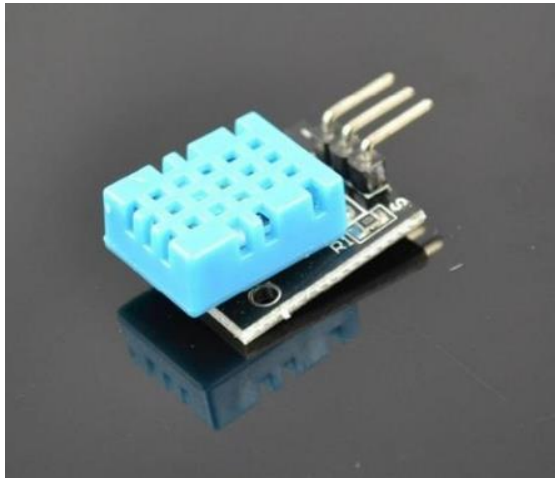
void loop()
{
  digitalVal = digitalRead(digitalPin);
  if(digitalVal == HIGH)
  {
    digitalWrite(led, HIGH);
  }
  else
  {
    digitalWrite(led, LOW);
  }
  analogVal = analogRead(analogPin);
  Serial.println(analogVal);
  delay(100);
}

```

---

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## DHT11 digital temperature and humidity sensor



The DHT11 3 Pin module can detect the humidity environment and temperature

Description:

Can be used with Arduino, Raspberry PI and other microcontrollers.

DHT11 provides temperature and humidity sensor with digital signal output calibrated.

The circuit board has provisions for fixing the hole with a diameter of 3.2mm.

Communication is done through a single two-wire serial interface.

Features include low power consumption, and high reliability excellent long-term stability.

Specifications:

- Humidity measurement range: 20% ~ 90% RH
- Humidity measuring error:  $\pm 5\%$  RH
- Temperature measuring range: 0 ~ 50 ° C
- Temperature measurement error:  $\pm 2$  ° C
- Working voltage: 5V / 3.3V
- Size: 28x12x8mm

	<pre>int DHpin = 8; byte dat[5]; byte read_data() {   byte i = 0;   byte result = 0;   for (i = 0; i &lt; 8; i++)   { while (digitalRead(DHpin) == LOW);     delay Microseconds(30);     if (digitalRead(DHpin) == HIGH)       result = (1 &lt;&lt; (8 - i));     while (digitalRead(DHpin) == HIGH);</pre>
--	---

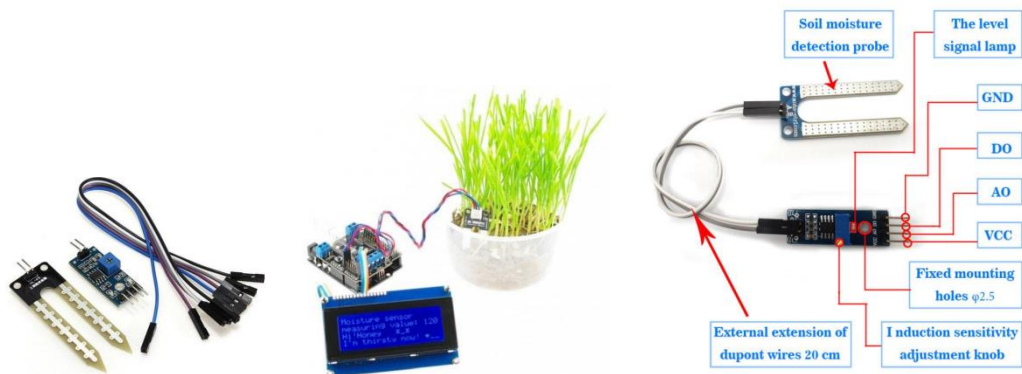
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	<pre> } return result; }  Void start_test() { digitalWrite(DHpin, LOW); delay(30); digitalWrite(DHpin, HIGH); delay Microseconds(40); pinMode(DHpin, INPUT); while(digitalRead(DHpin) == HIGH); delay Microseconds(80); if(digitalRead(DHpin) == LOW) delay Microseconds(80); for(int i = 0; i &lt; 5; i++) dat[i] = read_data(); pinMode(DHpin, OUTPUT); digitalWrite(DHpin, HIGH);  void setup() { Serial.begin(9600); pinMode(DHpin, OUTPUT); }  void loop() { start_test(); Serial.print("Humdity = "); Serial.print(dat[0], DEC); Serial.print('.'); Serial.print(dat[1], DEC); Serial.println('%'); Serial.print("Temperature = "); Serial.print(dat[2], DEC); Serial.print('.'); Serial.print(dat[3], DEC); Serial.println('C'); byte checksum = dat[0] + dat[1] + dat[2] + dat[3]; if (dat[4] != checksum) Serial.println("-- Checksum Error!"); elseSerial.println("-- OK"); delay(1000); } </pre>
--	---

---

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## Humidity sensor



Soil Hygrometer Humidity sensor compatible with Arduino detects the amount of water in the soil.

The sensor electrodes act as a variable resistor that will change from 100kohmi (when wet) to 2Mohmi in the dry state.

The sensitivity can be adjusted with a potentiometer.

Uses an LM393 voltage comparator.

Operating voltage from 3.3 V to 5 V.

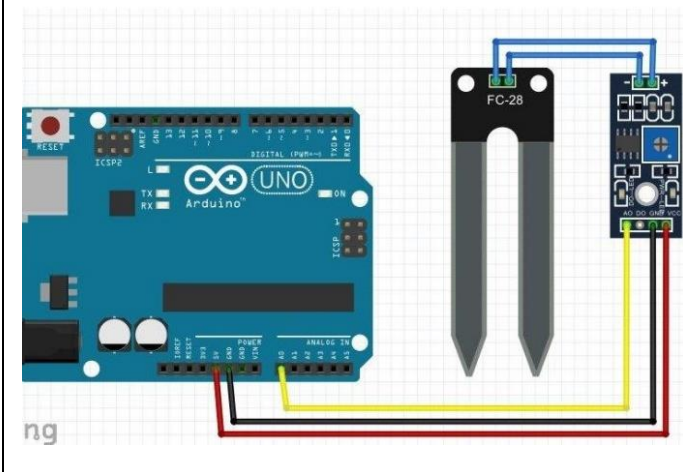
Pines:

A0 - Analog output

D0 - Digital output

GND - Ground

VCC - Positive voltage 3.3V - 5V



```
const int hygrometer = A0;
int value;
void setup()
{
  Serial.begin(9600);
}
void loop()
{
  value = analogRead(hygrometer);
  value = constrain(value,400,1023);
  value = map(value,400,1023,100,0);
  Serial.print("Soil humidity: ");
  Serial.print(value);
  Serial.println("%");
  delay(2000);
}
```

## Pulse sensor

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## Heart Rate Sensor Module (Pulse)

The Arduino pulse sensor is used to test your heart rate.

The heart sensor can be placed on the finger or earlobe.

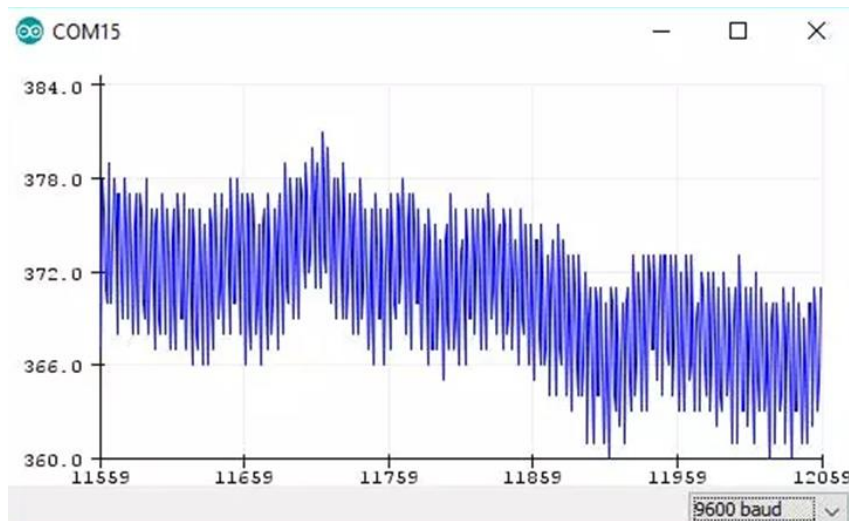
With an Arduino type application you can get a real heart rate chart in real time.

It is essentially an optical indicator with an amplification circuit with noise elimination.



The sensor has a positive connection, a negative connection and an analog data pin.

	<pre>int sensorPin = A0; void setup() {   Serial.begin(9600); } void loop () {   while(1)   {     Serial.print(analogRead(sensorPin));     Serial.print("\n");   } }</pre>
--	--



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## 4. Python - number transformation

*Gabriela-Bradusa Horlescu, teacher*  
*Vlad Tomescu, student*  
*“Gheorghe Cartianu” Technical College*

The numbering system is a set of rules for representing numbers by means of numbers and letters.

Example:

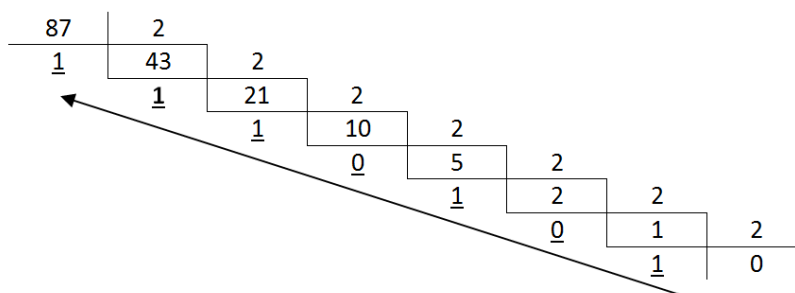
- Decimal system - numbering system based on 10, the number of digits used is 10, having the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9;
- Binary system - numbering system in base 2, the number of digits used is 2, having the digits 0, 1;
- Octal system - numbering system in base 8, the number of digits used is 8, having the digits 0, 1, 2, 3, 4, 5, 6, 7;
- Hexadecimal system - numbering system in base 16, the number of digits used is 16, having the digits 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and the letters A (10), B (11), C (12), D (13), E (14), F (15).

### Translation from one numbering system to another

#### 4.1. Passing natural numbers from base 10 to base 2

To convert a number from base 10 to base 2, divide the number by 2 and subtract the remainder, then subtract the number obtained by subtracting 2 and subtract the remainder, and so on. This procedure is continued until the number 0 is obtained, after which the number written in base 2 is obtained by writing all the remainders from the last to the first.

Example:



$$87_{(10)} = 1010111_{(2)}$$

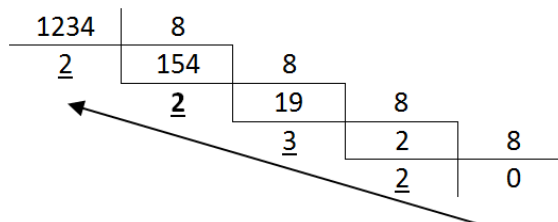
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## 4.2. Passing numbers from base 10 to base 8

To convert a number from base 10 to base 8, divide the number by 8 and subtract the remainder, then subtract the number obtained by subtracting 8 and subtract the remainder, and so on. This procedure is continued until the quotation mark 0 is obtained, after which the number written in base 8 is obtained by writing all the remainders from the last to the first.

Example:

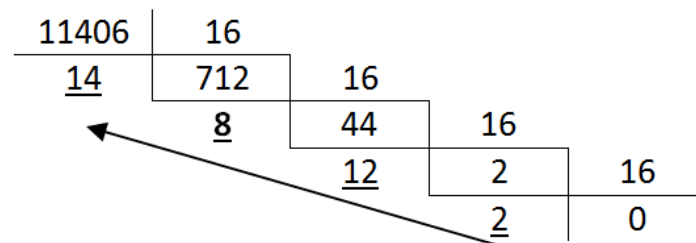


$$1234_{(10)}=2322_{(8)}$$

## 4.3. Passing numbers from base 10 to base 16

In order to pass a number from base 10 to base 16, proceed as follows: divide the number successively by 16 (then the quotas, etc.), keeping the remainders, after which, if they are 10, 11, 12, 13, 14, 15 are replaced respectively by A, B, C, D, E, F. This process is continued until the number 0 is obtained, after which the number written in base 16 is obtained by writing all the remainders from the last to the first.

Example:



$$11406_{(10)}=2C8E_{(16)}$$

## 4.4. Program for transforming numbers made in Python language

```
def base2(y):
    y = int(y)
    if y >= 1:
        base2(y // 2)
    print(y % 2, end="")
```

---

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```

def base2in10(y):
    y = int(y)
    z, i, n = 0, 0, 0
    while y != 0:
        j = y % 10
        z += + j * 2 ** i
        y //= 10
        i += 1
    print(z)

```

```

def base8in10(y):
    y = int(y)
    z = str(y)
    le = len(z)
    octal = 0
    for i in (range(le)):
        octal = octal + int(z[i]) * pow(8, le - 1)
        le -= 1
    print(octal)

```

```

def base8(y):
    y = int(y)
    if y >= 1:
        base8(y // 8)
    print(y % 8, end=")

```

```

def numere16(y):
    if y < 10:
        return str(y)
    if y == 10:
        return "A"
    if y == 11:
        return "B"
    if y == 12:
        return "C"

```

---

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```
if y == 13:
    return "D"
if y == 14:
    return "E"
if y == 15:
    return "F"

def numere16str(y):
    if y == "0":
        return 0
    elif y == "1":
        return 1
    elif y == "2":
        return 2
    elif y == "3":
        return 3
    elif y == "4":
        return 4
    elif y == "5":
        return 5
    elif y == "6":
        return 6
    elif y == "7":
        return 7
    elif y == "8":
        return 8
    elif y == "9":
        return 9
    elif y == "A":
        return 10
    elif y == "B":
        return 11
    elif y == "C":
        return 12
    elif y == "D":
        return 13
    elif y == "E":
        return 14
    elif y == "F":
        return 15
```

---

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```

def base16(y):
    y = int(y)
    z = ""
    while y > 0:
        valoare = y % 16
        y //= 16
        z += numere16(valoare)
    print(z[::-1])

```

```

def base16in10(y):
    z = len(y) - 1
    valoare = 0
    for i in y:
        valoare += numere16str(i) * 16 ** z
        z -= 1
    print(valoare)

```

```

x = input("numar = ")
alegere = input("baza: ")
if alegere == "2":
    base2(x)
elif alegere == "10":
    alegere2 = input("din baza: ")
    if alegere2 == "2":
        base2in10(x)
    elif alegere2 == "8":
        base8in10(x)
    elif alegere2 == "16":
        base16in10(x)
    else:
        print("eroare")
elif alegere == "8":
    base8(x)
elif alegere == "16":
    base16(x)
else:
    print("eroare")

```

---

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The program can be run online: <https://www.online-python.com/>

```
Run Share Command Line Arguments
numar =
87
baza:
2
>_ 01010111
** Process exited - Return Code: 0 **
Press Enter to exit terminal
```

```
Run Share Command Line Arguments
numar =
1234
baza:
8
>_ 02322
** Process exited - Return Code: 0 **
Press Enter to exit terminal
```

```
Run Share Command Line Arguments
numar =
11406
baza:
16
>_ 2C8E
** Process exited - Return Code: 0 **
```

---

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