Arduino pH measuring System

Proposed by
Arsakeio High School of Patras

A Trainers Toolkit To Foster STEM Skills Using Microcontroller Applications

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

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Arduino pHmeasuring System

Contents

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Aim

Use the Arduino pH measuring system to explain and help students automate measure the pH parameters of a strong basic or strong acid solution

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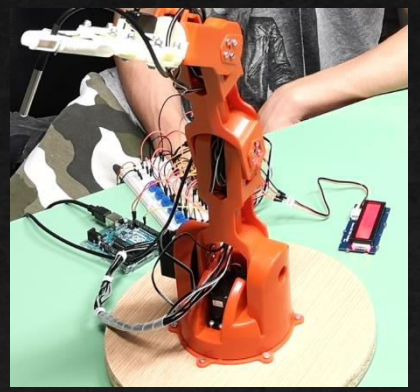
Description

- pH is an indicator of the strength of acids and bases, the most common used chemical compounds in a school lab.
- pH plays a crucial role in the classification of solutions and in their protection during handling. Plants and animals have been shown to choose the right pH to grow. Various plants grow and produce better fruits in a specific pH environment, while they are unable to grow beyond any limits.
- The quality of water consumed by the human body is of particular importance. Specifically, according to JMC Y2 / 2600/2001 (Government Gazette 892B / 11-7-2001) "Quality of water for human consumption", in accordance with Directive 98/83 of the Council of the European Union of 3 November 1998, the pH limit is set of water for human consumption is between 6.5 and 9.5. When water has high pH (strong bases) or low pH (strong acids), beyond the limits, it is dangerous to human health and should be handled properly.

A typical ph meter



Arduino ph measuring system

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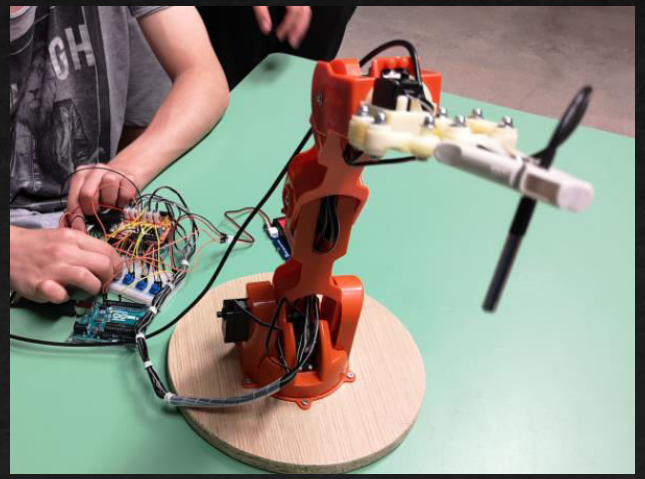
Description

- The pH measurement can be done either in laboratories or with the use of portable electronic devices such as the pH meter or arduino pH meter.
- Arduino pH measuring system consists of microcontroller, relay, pH measuring sensor, pump, power source and a robotic arm.
- With these components, you can easily build a system powered by Arduino. In combination with the robotic arm , the system responds to solutions that have extreme values of acids or bases that can harm the students.
- In this simplest way, students will learn how microcontrollers can be used in a chemical laboratory when they need to measure pH on extreme conditions of acidity or alkalinity.



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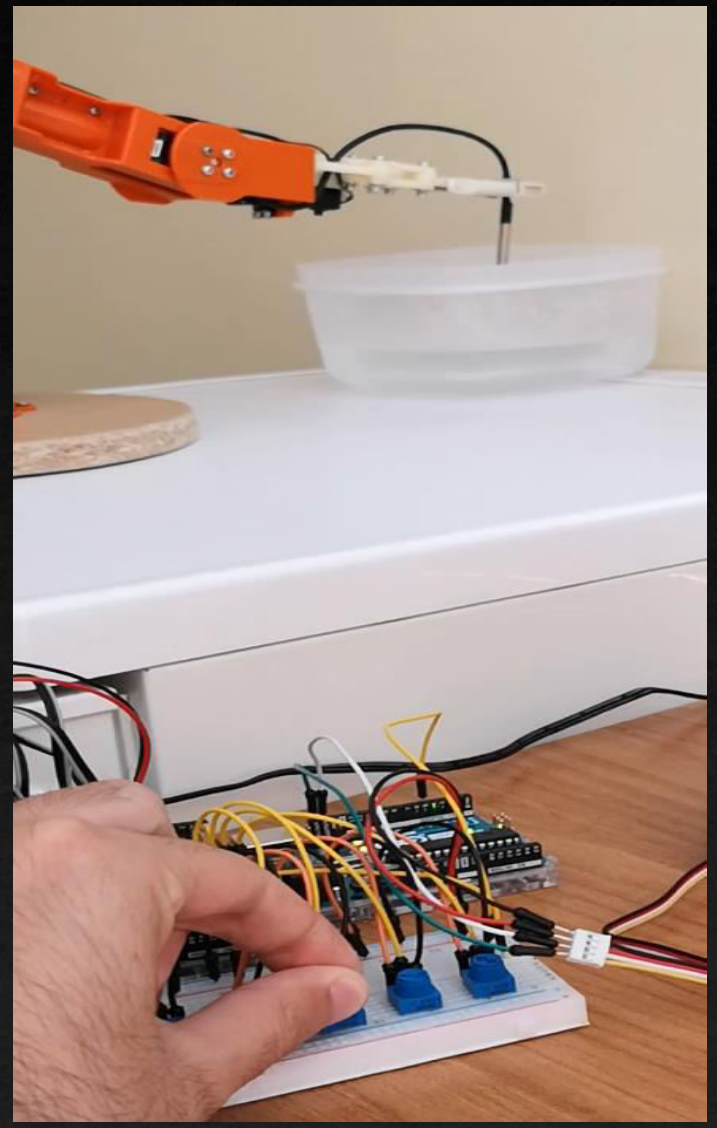
Learning Goals

- Students understand the basic principles of electronics and Chemistry
- Students understand the role of pH in the quality of water
- Students will understand how electronics can automate everyday activities in a chemical lab.



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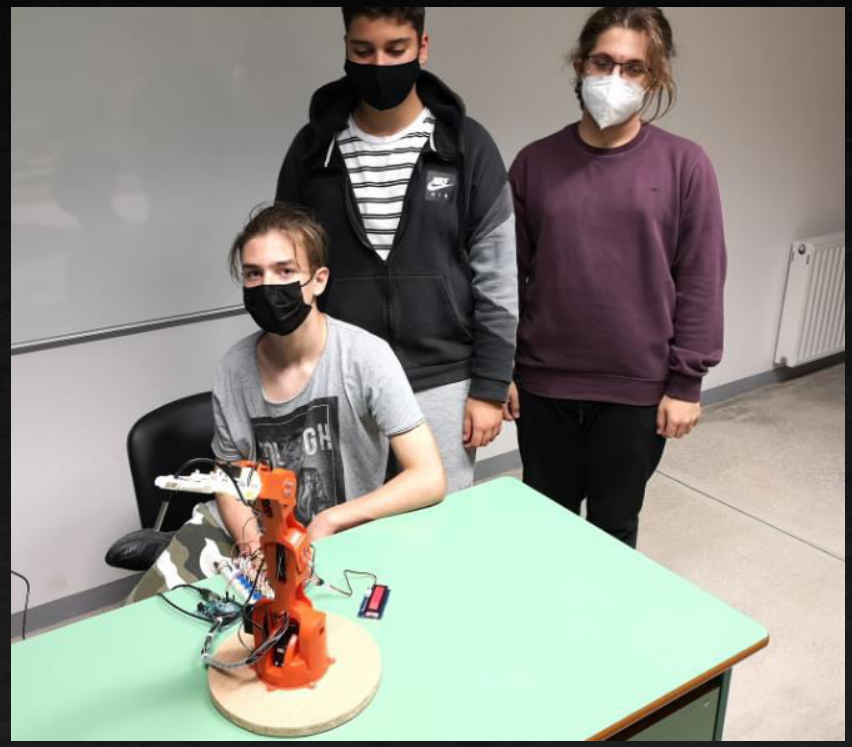
Learning Methodologies

- Students discover materials that show acidic or basic properties from our daily life (such as vinegar, lemon juice, baking soda, shampoo).
- The teacher assigns groups to measure the pH of different solutions .
- At the end of the project, the students draw conclusions as to which solutions the use of the arduino measuring system is mandatory due to safety limits .



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Target Group

Secondary school students

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Learning Schema

- Students are divided into groups. After the groups talk for about 2 minutes, the leader of each group announces their views which are the initial assumptions - forecasts about the necessity the pH values and the way of measuring it.

- pH measurements are taken of the respective acid, neutral and basic solutions.

- Each group is asked to count the pH of the solutions in different ways and compare it with the expected value.

- Define pH as a quantity that serves to compare acidity or alcalicity.

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Solution

Source: ethnos.gr

A particularly important element of this course is that it transforms the school laboratory to a researcher laboratory of the future, thus stimulating the interest of the student who may become the researcher of tomorrow.

It also emphasizes the relationship science and technology since technology is called to find solutions - here ways to take measurements - under adverse conditions such as the presence of radioactivity in a pH measurement cooling water in a reactor, or on a volcano or on the surface of another planet.

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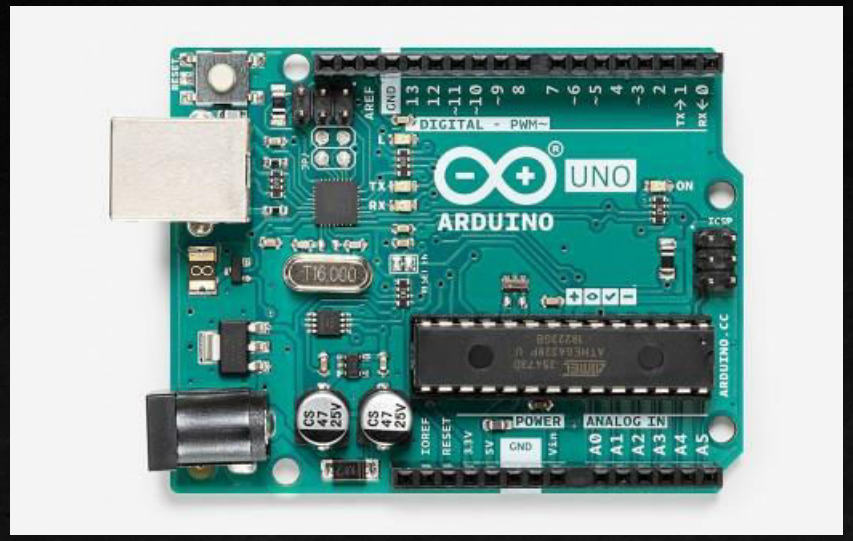
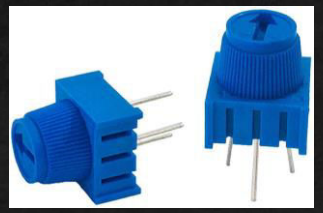
Solution

- The following components are required for preparation:



- ARDUINO UNO
- Robotic Arm
- Ph Sensor



- Potentiometers
- Jumper Wires
- 12V power source

Source: Store.arduino.cc

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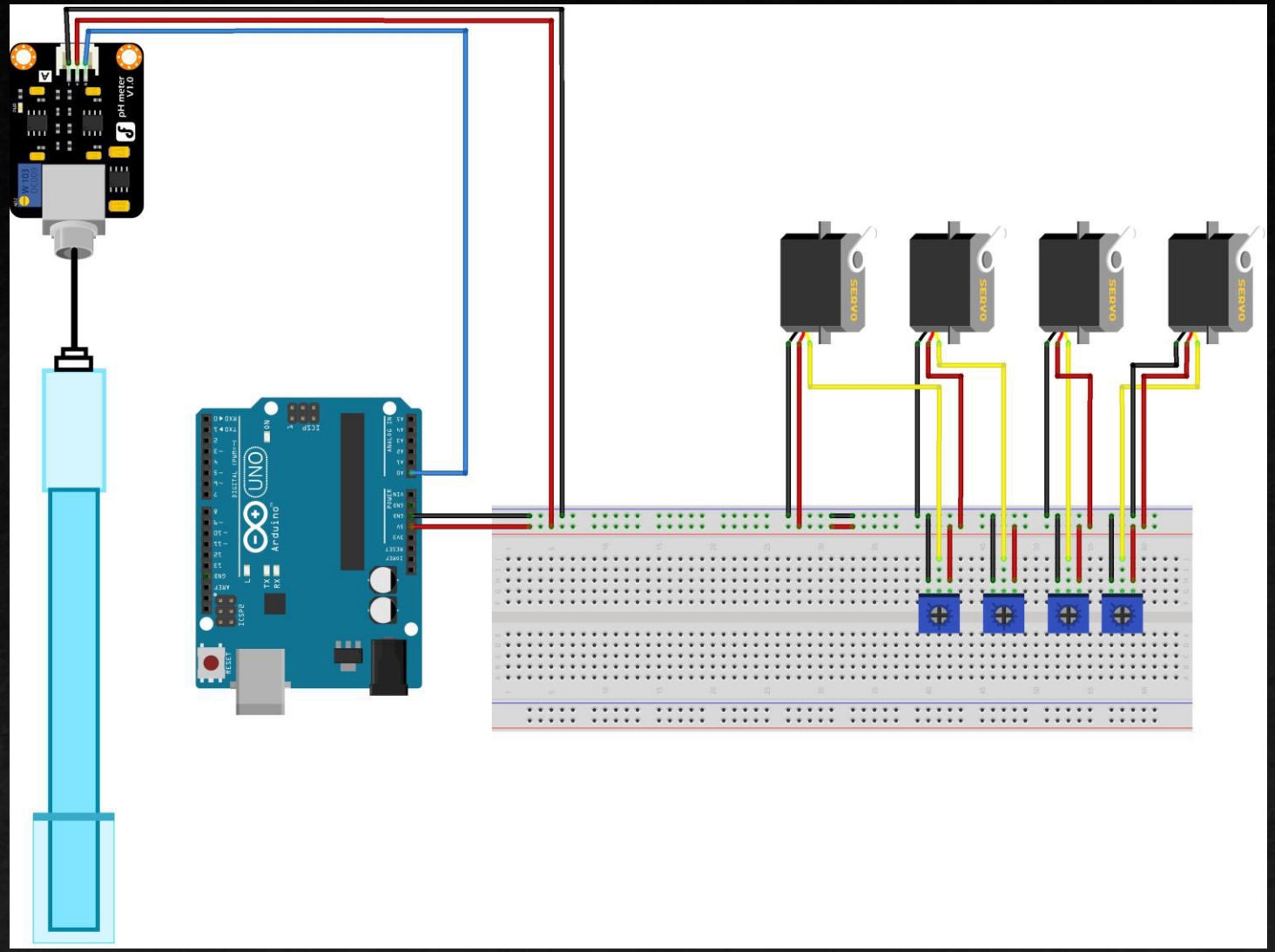
Solution



<- Wiring diagram of all circuit components.

You can easily write the software to control the circuit yourself by reading the manual or look for a ready-made project on the Internet.

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Scientific Areas Covered

Chemistry / Technology / Informatics

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Assessment

- The evaluation should be achieved through long-term student engagement.
- During the discussion, students can be debriefed on basic issues.
- The student should be able to identify basic relationships.
- Finally, promotes the idea of interdisciplinarity, since during the implementation and completion of it students deal in parallel with more than one cognitive objects.

Source: Science lab

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Bibliography

1. Alimisis, D., Karatrantou, A., Tachos, N. (2005), Technical school students design and develop robotic gear-based constructions for the transmission of motion, Eurologo 2005,
2. Carr, M. (1984). Model confusion in chemistry. Research in Science Education, 14, 97- 103. Digital Tools for Lifelong Learning, Proceedings, Warsaw, Poland, 76-86.
3. Satratzemi, M., Dagdilelis, V., Kagani, K, (2005). Teaching Porgramming with robots: A case Study on Greek Secondary Education, P. Bozanis, E.N. Houstis, (Eds.), Lecture Notes in Computer Science (LNCS), 3746, 502-512.
4. Tinkerkit Braccio Manual
5. Arduino UNO Manual

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