

## LOW COST METEOROLOGICAL STATION AS A INSTRUMENT OF INTERDISCIPLINARY PRACTICE AT COLÉGIO ESTADUAL OTACÍLIO MOTA IN IPUEIRAS-CE

Prof. Antonio Ronaldo de Paiva Moura  
Prof. Francisco Samuel Gomes de Araújo  
Colégio Estadual Otacílio Mota

**Participantes:** Antonio Janderson de Sousa Lima e Pedro Henrique Barros Aragão

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### ABSTRACT

This project is based on the development of a low cost weather station as an interdisciplinary instrument in high school at the Otacílio Mota State College. For the construction of the instrument, several recycled materials were required, as well as sensors for automatic data collection. All information transfer took place without the help of man, through a network connected to a laptop computer. The overall objective of the project was achieved, where we obtained the implementation of a Low Cost Meteorological Station, with measurements of temperature, air humidity and wind speed, for pedagogical use in high school. The Arduino platform was used, with also a software for automatic reading of the data obtained by the sensors, making the whole prototype structure fully functional.

**Keywords:** Arduino, Meteorology, Educational Robotics, Learning

## ESTAÇÃO METEOROLÓGICA DE BAIXO CUSTO COMO INSTRUMENTO DE PRÁTICA INTERDISCIPLINAR NO COLÉGIO ESTADUAL OTACÍLIO MOTA EM IPUEIRAS-CE

### RESUMO

O referido projeto baseia-se no desenvolvimento de uma estação meteorológica de baixo custo como instrumento interdisciplinar no ensino médio no Colégio Estadual Otacílio Mota. Para construção do instrumento, foram necessários diversos materiais reciclados, além de sensores para coleta automática de dados. Toda transferência das informações ocorreu sem a ajuda do homem, através de rede conectada a um computador portátil. O objetivo geral do projeto foi alcançado, onde obtivemos a implantação de uma Estação Meteorológica de Baixo Custo, com medições de temperatura, umidade do ar e velocidade do vento, para utilização pedagógica no ensino médio. Foi utilizado a plataforma *Arduino*, com também um *software* para leitura automática dos dados obtidos pelos sensores, tornando toda a estrutura do protótipo completamente funcional.

**Palavras Chave:** Arduino, Meteorologia, Robótica Educacional, Aprendizagem

### INTRODUCTION

Weather-related learning is related to the branch of science called meteorology. The technological development observed in recent years, especially in the area of electronics and automation, allows monitoring of countless aspects in real time and precision never

seen before. Teaching and learning procedures, especially in didactics, provide teachers with their own work methodologies, allowing students to acquire knowledge. Thus, according to Libâneo (1994, p. 28), the didactic process is effective from the school mediation, with the contents and learning in the formation of society.

In this sense, the low-cost meteorological stations emerge as an important tool as an interdisciplinary school practice, expanding from practical classes the knowledge in the various disciplines of knowledge, such as Geography, Mathematics, Portuguese, Robotics, among others. Therefore, in addition to arousing interest on the part of students, the study through the use of the Meteorological Station, motivates them to resolve doubts in content related to weather and climate, as well as an opportunity for a connection between theoretical and practical classes.

The study through the Low Cost Meteorological Station, starts the fascination in the students, considering that it gives them the opportunity to define the climate in the different regions of the Earth's surface, as well as the atmospheric behavior on a global, regional and local scale. Thus, by stimulating a taste for studies, students are bewitched by the climate dynamics, providing interdisciplinary knowledge in other areas of knowledge throughout basic education, with the use of didactic practices and resources, in addition to the technological knowledge very widespread in education. basic at present. This project uses a Low Cost Meteorological Station, composed of sensors that collect data from the environment in which it is stored. Furthermore, after capturing the meteorological parameters, these data are stored in a central memory unit, known as a data logger, which is later made available to the users. However, Low Cost Weather Stations can transmit and store data automatically, reducing the possibility of errors throughout the process.

However, the data collected by the Low Cost Meteorological Station can be used in several areas of knowledge, especially in weather forecasting, in view of its importance for agricultural activities, climate characterization, in addition to the prevention of environmental disasters. in urban and rural areas. Thus, BRAGA (2011) defines the composition of a professional meteorological station:

The equipment that makes up the weather stations can be separated into three main categories: sensors, recorders and telemetry. Sensors

translate physical events into electrical and electronic signals and are responsible for quantifying several meteorological parameters, the most common in meteorological stations: precipitation, relative humidity, air temperature, wind speed, wind direction, solar radiation (incident and reflected) and atmospheric pressure.

A Low Cost Meteorological Station leveraged in this project was designed on an Arduino basis, a free hardware prototyping platform developed in Ivrea (Turin province in Italy), often used in robotics and electronics for its ease of building interactive projects. Likewise, the project has the necessary sensors to monitor the basic and fundamental data for a Meteorological Station in compliance with the National Institute of Meteorology (INMET). Therefore, with the high costs in a Professional Meteorological Station, it was decided to design a Meteorological Station with small costs, and its results are worked by high school students at Colégio Estadual Otacílio Mota, in the municipality of Ipueriras-CE, enhancing scientific research. through practical and ongoing experiments.

## **MAIN GOAL**

Develop and implement a small Low Cost Meteorological Station, aiming to obtain data on temperature, air humidity and wind speed, for further analysis by high school students.

## **Specific objectives**

- Run a low-cost microcontrolled system with sending meteorological data for subsequent use and learning in basic education.
- Study the operation through the practice and analysis of meteorological data originated through a temperature sensor.
- Acquisition and subsequent assessment of wind speed through a low cost anemometer.
- Develop a relative humidity measurement system.
- Foster creativity and curiosity for research in students, highlighting robotics concepts, in addition to enhancing interdisciplinarity in basic education, especially in high school at Colégio Estadual Otacílio Mota.

## **METHODOLOGY**

Initially, only three sensors were chosen for the use of the Meteorological Station to carry out the climatic measurements: temperature, air humidity and wind speed. The development of this project was possible through a few stages, as follows: in the 1st stage, the students carried out a preliminary survey of knowledge about electronics and robotics, in addition to the presentation of the low-cost materials that would be used. In the 2nd stage, students were exposed to classes to present the Arduino System and its components, as well as obtaining low-cost sensors for measuring temperature, relative humidity and wind speed. Continuing, in the 3rd stage, it was possible to download a free software that reads the climatic data worked on in the project. In the 4th stage, the students together with the tutors, carried out the assembly of the Low Cost Meteorological Station, analyzing and discussing the data originated in an experimental way. In the 5th and last stage, data collection was carried out from the aforementioned Meteorological Station inside the School, where the project participants concluded that the devices and equipment were working properly.

### **RELEVANCE OF THE PROJECT**

The idea of setting up a Low Cost Meteorological Station arose from the curiosity of some students, together with the tutors of Mathematics and Geography, with the support of the Robotics Club of Colégio Estadual Otacílio Mota in Ipueiras-CE. Equally, it was the interest in the behavior of natural phenomena, especially meteorological phenomena, which occur at a local and regional level that made possible the construction and materialization of the presented project.

It is essential to highlight that it was impossible to carry out the project, working with a professional Meteorological Station, in view of the high cost of its construction. Furthermore, the participants, with the support of the Clube da Robótica da Escola, built a Low Cost Meteorological Station, with recycled material and fully automated. In this sense, data collection and consequently their analysis was possible, with the help of a computer connected to the Meteorological Station.

### **PROJECT IMPACT**

In contemporary times, technological advances are increasingly accelerated, directly impacting society and current educational changes. With the execution of the project, Low Cost Meteorological Station, it was possible the interdisciplinarity between the disciplines of Mathematics, Geography, among others, in the educational context of the highlighted School. In the same way, it was possible for the participating students to get involved, especially the Robotics Club, who actively organized and carried out actions, with autonomy and logical reasoning, in addition to developing cooperativism, becoming participants in scientific knowledge on the ground. from school.

### **SEARCH RESULTS**

This idea arose from the need of students and teachers of Colégio Estadual Otacílio Mota, to gather knowledge through the exchange between school and university, as well as expand knowledge related to the theme worked, in view of the difficulties faced on the school floor. In this sense, the construction of the Low Cost Meteorological Station enabled participants to gain in-depth knowledge of climate dynamics, mathematics, geography, in addition to Physics and Chemistry, as well as educational robotics.

It is worth noting that any attempt to simplify teaching methodologies, as well as research, is of fundamental importance for the intellectual development of students. In the same way, the project of the mentioned Meteorological Station, is in the process of improvement, where it will be worked during the whole school year, aiming at the improvement of the collected data and of the future cataloged analyses.

In this sense, the project presented has the power to develop a new teaching methodology in the crafted School with the help of educational robotics, improving mathematical and geographical knowledge, encouraging cooperative work, stimulating creativity on the part of students, since, provides interdisciplinarity and greater contextualization of school curricula. Likewise, critical thinking and the search for knowledge were developed in the school community.

### **FINAL CONSIDERATIONS**

With the development of the work, there was a greater interaction between the participants, especially in robotics and geography. Likewise, it was possible in a practical way to analyze climate variations, even in an experimental way. With the continuity of the project, students together with their teachers, aim to expand by adding other instruments and sensors for a greater understanding of meteorological phenomena.

On the other hand, with the implantation of the Robotics Club at Colégio Estadual Otacílio Mota, and the construction of the Low Cost Meteorological Station, it provided the insertion of educational technologies on the school floor. In addition, even with many difficulties, success in learning becomes real, when one enthusiastically participates in intellectual development, in learning related to their daily lives, aiming at an interdisciplinary and holistic education.

From this moto, the low cost of the meteorological station makes it viable for the acquisition of other instruments, with a view to the future expansion of that project, therefore, to improve the quality of the data presented for study, at local, regional and even national levels. . Even with the project, it is believed to be of great value in teaching aid for teachers of different subjects in basic education, especially in high school. Thus, the teacher can make use of the equipment to monitor climate variations, streamlining their classes with differentiated and comprehensive methodologies.

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