

Development of a Low-cost pH Meter using Arduino Programming

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A pH meter is an electronic device that measures the acidity or alkalinity of solutions by combining a pH sensor with a temperature sensor for a complete pH meter. The study was undertaken to create a low-cost pH meter with high accuracy. It is essential to measure accurate H⁺ ions in water-based solutions for various purposes such as aquaculture, water quality testing. The pH meter is an essential device for laboratories such as medicine, food, and agriculture. In today's world pH meters are very expensive and need to pay more to buy a pH meter and that is a major issue for laboratories when importing pH meters. Different varieties of pH meters are commercially available in the market. The specialty of this research is the preparation of low cost of production nearly 6 times, compared to the commercially available similar pH meters. The designed pH meter is Arduino-based and the power supply via USB. Analog voltage signals are used to take the readings. A pH glass electrode sensor of a range of 0-14 and a DS18B20 temperature sensor was used. The voltages were measured by adding the pH sensor in pH 4.01, 7.01, and 10.01 standard buffer solutions. Then a graph of the pH vs. voltage was plotted and a mathematical model to calibrate the pH sensor was created using the piece-wise linear interpolation. The temperature sensor was calibrated at 0 and 100°C. The pH and temperature readings taken by the laboratory pH meters and thermometers were compared with the designed pH meter readings. The finalized device contains a menu especially for the calibrations and the adjustments by having major 4 sections as sensor calibrations, display settings, output mode, and the about device. The accuracy is up to 2 decimal points of pH and the stabilization values are given less than 30 seconds. It is identical to a pH meter found in a standard laboratory and the outcome of the study is a low-cost pH meter. Because of its user-friendly interface, simple calibration process, and high level of accuracy at a reasonable price, the pH meter can be used instead of existing pH meters.

Keywords: pH meter; Low-cost pH meter; pH sensor calibration; Temperature sensor calibration; Piece-wise linear interpolation