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" Web Application for Real Time Data Visualization of Heat Sensors "

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Graphical Abstract

Abstract. Calorimetry [1-5] and real-time monitoring systems [2,6-9], are essential aspects in environmental and agroindustrial processes. In this work, we develop a web application [6] that allows to remotely visualize continuous graphs of data coming from heat sensors connected to an Arduino device [10] with Internet access. The information is initially stored in a MySQL database [11-13], which reactively [14,15] generate the graph and the calculation of descriptive statistics [2,6-9].

Introduction

Agroindustrial processes require real-time monitoring tools[2,6-9] and automated control, which allow for a visual follow-up during the phases of their development, and for a subsequent processing and analysis of data, specifically on processes in the which depends on the temperature. In order to carry out measurements and tests of electronic components, eight sensors connected to an Arduino board, which sends the information obtained through the internet, have been placed on a liquid conduction channel, variable temperature in relation to time[10,16] by means of your Wi-Fi device, to a database for storage, and immediately graphical the output of dynamic Datasets and their descriptive statistical indicators, within a certain configured range of maximum and minimum value in a web application reactive and optimized.[9,14,15,17,18]

Materials and methods

For the development of real-time monitoring software, an Arduino computer with temperature sensors was used, which emits its signal through a PHP / GET application with 8 numerical variables housed in a 64-bit Linux shared server, with MySQL, where stored values are stored from the sensors of an Arduino equipment called Heater, Concentrator, Evaporator3, Evaporator2, Evaporator1, Sensor7, and Sensor8. Technological tools such as Nodejs [19] are used through WebSockets [9,16] with a pooling interval setting of 500, and a reactive application [15] developed in Angular5 [14,17] using the external graphical library ng2-chart, and material angular, by subscription to the service through an Observable object, provided by the module httpClientModule.

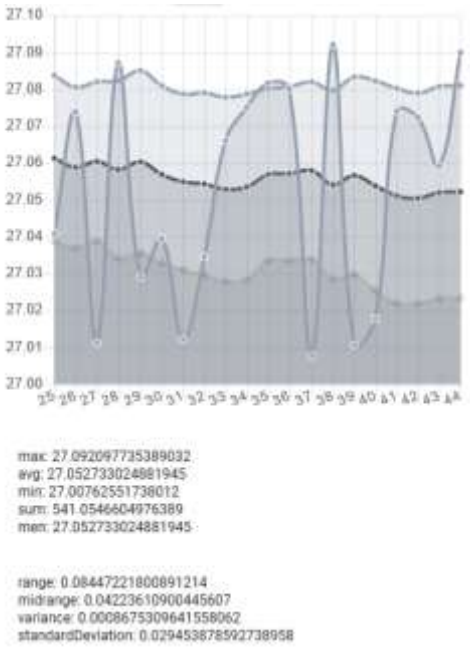
Results and Discussion

During the data collection, 84903 records are obtained corresponding to 16 processes performed on different dates whose averages are shown in table 1, and random test values greater than 1000, called Testing Values. [T-V]

Date	Sensors							
	Calentador	*Concentrador*	*Evaporador 3*	*Evaporador 2*	*Evaporador 1*	*Sensor 6*	*Sensor 7*	*Sensor 8*
24/04/2018	66,9	100,2	93,9	92,6	89,4	[T-V]	[T-V]	[T-V]
25/04/2018	[T-V]	[T-V]	[T-V]	[T-V]	96,9	[T-V]	[T-V]	[T-V]
26/04/2018	71,0	[T-V]	80,4	79,1	81,9	[T-V]	[T-V]	[T-V]
27/04/2018	83,4	[T-V]	99,7	98,5	96,3	[T-V]	[T-V]	[T-V]
03/05/2018	12,0	12,0	12,0	12,0	12,0	[T-V]	[T-V]	[T-V]
07/05/2018	48,2	106,3	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]
08/05/2018	24,4	24,0	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]
09/05/2018	165,1	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]
10/05/2018	44,3	59,4	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]	[T-V]
11/05/2018	62,3	104,8	84,7	74,4	84,5	[T-V]	[T-V]	[T-V]
15/05/2018	[T-V]	124,3	98,5	96,4	91,9	[T-V]	[T-V]	[T-V]
23/05/2018	99,9	113,3	98,1	[T-V]	71,9	[T-V]	[T-V]	[T-V]
29/05/2018	27,2	24,5	26,5	31,5	48,6	[T-V]	[T-V]	[T-V]
31/05/2018	73,5	116,7	93,7	98,2	95,0	[T-V]	[T-V]	[T-V]
11/06/2018	77,3	123,6	98,9	95,8	[T-V]	[T-V]	[T-V]	[T-V]
12/06/2018	73,8	113,0	98,7	213,1	[T-V]	[T-V]	[T-V]	[T-V]

Table 1: Average values stored in the database

The website developed for this purpose shows the maximum value, minimum sum of values, average, range, mean range, variance and standard deviation in real time.



The web application is capable of receiving data from any authorized device that has an Internet connection, where you can observe the behavior of the data based on the time between a set range, initially supports 8 simultaneous sensors, and its accuracy is determined for the accuracy of the measuring instruments. The numerical values of the dynamically generated Datasets can be treated according to the experiment carried out since each of the sensor graphs are individual legacy containers, thus allowing vertical scalability in terms of measurement hardware.

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