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Study of low-cost Arduino Uno based system to determine the response and recovery times of humidity sensor

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Abstract: In this work, we have studied humidity sensor behaviours with a low cost experimental setup using Arduino UNO board. The proposed technique exploits sensing capability of the DTH22 sensor, to determine its response and recovery times. The D.C voltage of +5V is applied to the sensor and the output voltage is measured using Arduino UNO board with the help of buffer circuit. The sensor has shown response time of 8s and recovery time of 1s. This study emphasised that the DHT22 sensor is a better humidity sensor between 9-99% RH.

Keywords: Arduino uno, Embedded system, Sensor, IC 741 op-amp , DTH 22, recovery time and response time.

INTRODUCTION:

In this Artificial Intelligence (AI) era, sensors are playing vital role. In AI systems humidity sensor has an important role. The humidity sensors have gained importance as it finds applications in many disciplines of life namely: medicine, food processing industry, libraries, electronic and agricultural industries [1,2]. Fabrication of a good and efficient humidity sensor with good response and recovery time is a crucial parameter[3,4]. The humidity sensors should exhibit high sensitivity, wide sensing range, and short response/recovery time[chenthan].

In the present work, the focus is on a low cost experimental setup to study humidity sensor performance. With this in view, this research work, studied the response and recovery times of the chosen the DHT 22 sensor accurately tested in liquid nitrogen environment.

Hardware circuit:

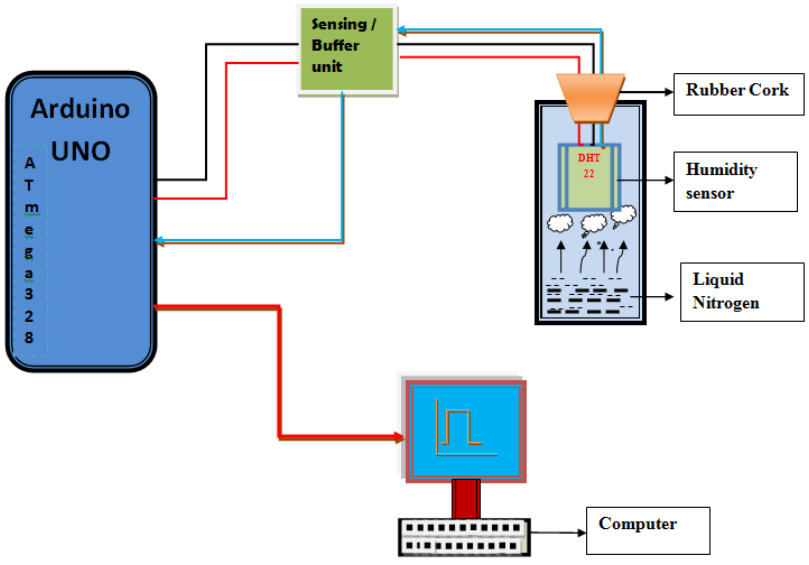

Figure 1: Low cost experimental set up for humidity sensing studies.

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Hardware:

This work mainly used following devices

1. Embedded microcontroller
2. Sensing unit
3. Testing environment
4. Analysis unit

Embedded microcontroller: The Arduino UNO R3 board consist the Atmega328P chip, it is used as the embedded chip. Arduino is an open source programmable board. It is very easy to use and powerful single board computer [5]. The Arduino UNO R3 read the sensor data through sensing unit. The microcontroller reads the sensing data in real time for analyzing its sensing behavior. After that, the same data is sent to PC through serial communication. With the help of Origen6.0 software, timing behavior graph is plotted. In that plot the time of response and recovery of DHT 22 sensor behavior is noted.

Sensing unit: This unit consist the DHT 22 and buffer unit. The buffer unit made with op-amp IC741 to provide stable power supply to protect the sensor[6]. The op-amp is used as voltage follower to provide stable +5V for sensor. The IC 741 op-amp is cheap and best device to provide voltage stability[7].

Testing environment: The sensor behaviour is tested in humid environment by using liquid nitrogen. For testing purpose liquid nitrogen is used because it is extremely cold and is used generally for many cooling and cryogenic applications. Liquid nitrogen boils at 77 K (−195.8° C or −320.4° F). Liquid nitrogen has many uses, mainly based on its cold temperature and low reactivity. The sensor is inserted in liquid nitrogen container and closed with rubber cork. After a second the sensor is removed from the container. Two cycles are completed this way readings are taken and recorded with the help of Arduion Uno micorocntroller. The sensor sensing the humidity in the range of 11%- 99% RH and the response and recovery time was estimated [8,9].

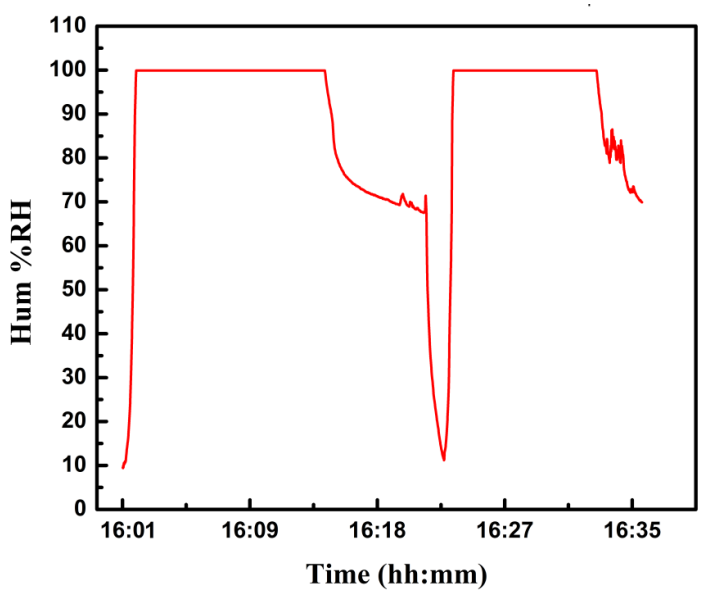

Figure 2: Response and recovery characteristic curve of DHT22 sensor

Humidity sensing depends very much on two criteria: response time and recovery time[9]. These characteristic were measured separately, once for low RH of 11% and another for high RH of 97%.[10]

RESULTS AND DISCUSSION

The system is used to study the sensing behavior of Humidity sensors. In the present work the experimental setup is developed with low cost. The developed system is tested for DHT22 sensor and recorded the humidity data RH in real time. Tabulated the recovery and response time with the help of origin 6.0 software after the plotted the graph. This gadget is successfully tested the sensing behavior of DHT22 sensor. As the components used are less in number and power consumption is less. This makes the device portable, handy and easy to use.

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Sl. No	Sensor	Response Time in seconds	Recovery Time in seconds
1	DHT 22	8	1

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