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Actual Time wireless communication application for Microcomputer System Based on Data Acquisition

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Abstract

Promising remote interactive solutions are offered by the RTC wireless multi-channel data gathering systems. In order to identify and analyze data, this study constructs and uses wireless octet channels. Using an Arduino-Uno connected to National Instruments (NI)-LabVIEW, the data analysis and the appropriate control action will be carried out. A straightforward and user-friendly graphical user interface (GUI) has been created and put into use. The ambient parameters are read using passive infrared (PIR) sensors for temperature, pulse, humidity, and motion. The system offers the possibility of high accuracy data measurements, such as those for temperature and humidity, as well as individual measurements of eight parameters at various reading rates. The means values approach is used to collect correct data for the three sensors in the two described scenarios. Additionally, an effective storage method is employed. It keeps time- and date-stamped information that enables cancellation of any subsequent repeated measurements. The system will only save the most recent updates whenever the environmental parameters have changed. This can significantly reduce the amount of memory needed while yet providing an accurate enough representation of the sensor output. As triggering signals for the actuators, quad flags are used. Finally, this system allows for remote monitoring of the collected data using either a computer or a smartphone with a wifi local area network (WLAN) coverage.

Keywords

LabVIEW, Arduino-Uno, GUI, DAS, Real-Time

1. Introduction

The most important entry points for data collecting systems may be considered to be the rapidly developing sensors, controller platforms, and produced soft packages. By employing sensors of the data collecting systems, many environmental characteristics, such as motion, temperature, humidity, and heart rate pulses, may be precisely monitored and translated to their corresponding electric signals [1]. The data collected can be utilised to either track system history or to operate the appropriate machinery or specialised appliances. Nevertheless, dealing with time-varying signals is usually essential in addition to handling solely static data. Either capacity or data gathering rates are the issues with data acquisition systems. Some systems may require data to be gathered gradually, over several days or weeks. The second will require quick bursts of high-speed data capture, possibly at rates as high as several thousand readings per second. Even though numerous data collection systems have employed specific sensors [2, 3], neither the data obtaining speed nor accuracy have been covered. Indeed, the data acquisition rate is inversely related to the anticipated storage memory need [4],[5]. However, a number of alternative algorithms have been applied for data measurements and storage [6], resulting in an effective operating system. This study employs several, comparable sensors for multiple inputs of various data types as well as for the removal of measurement errors. Additionally, a linked Arduino through the VISA tool to LabVIEW allows for real-time sensor readings at the website and a spreadsheet file storage of non-duplicate data.

1.1. Configuring the Channels

Sensors make up the system, three of which can measure temperature with precision to two decimal places utilizing DS18B20 Eagles. Three more DHT11 sensors are used to monitor humidity, motion using a PIR motion sensor, and pulse using a pulse sensor that measures heart-sensitive pulses. In the block diagram (Figure 1), each of them is succinctly depicted.

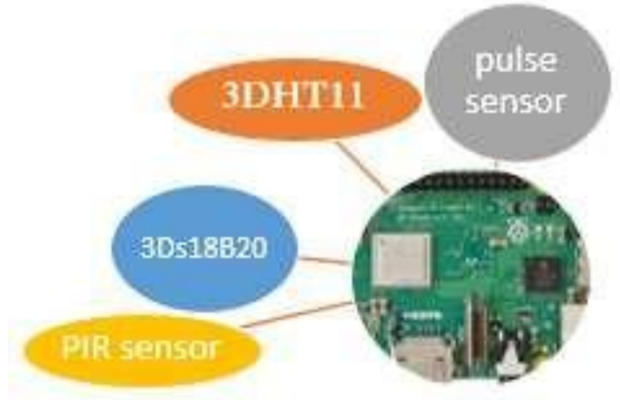

Figure 1. Block diagram of the system

2. Sensing, storing, recording, and publication of data

The configuration and operation of the system are illustrated in the paragraphs that follow.

2.1. Sensors

When reading physical quantities like temperature, humidity, heart rate, and mobility, sensors are the crucial input component. We shall define both sensors in this section. The two kinds of analogue and digital signals can be read by these sensors. The pulse sensor reads analogue signals, whereas the DHT11, DS18B20, and PIR sensors read digital signals. The accuracy of the DHT11 sensor has two values (the minimum is 1°C and the highest is 2°C), the DS18B20 sensor has an accuracy of 0.5°C, the pulse sensor's precision varies greatly depending on where you place it, and the PIR motion sensor detects motion across an area of roughly 120° and 7 metres.

2.2. VISA tool

The visa utility is employed to write Arduino serial monitor data to LabVIEW. Visa is a protocol that allows LabVIEW to communicate with any other device depicted in Figure 2 by first collecting commands from the serial monitor at an 115200 baud rate. The front panel of LabVIEW displays the four conventional temperature, motion, humidity, and heart rate sensors. Along with smart data saving, the measured data would be published on the website.

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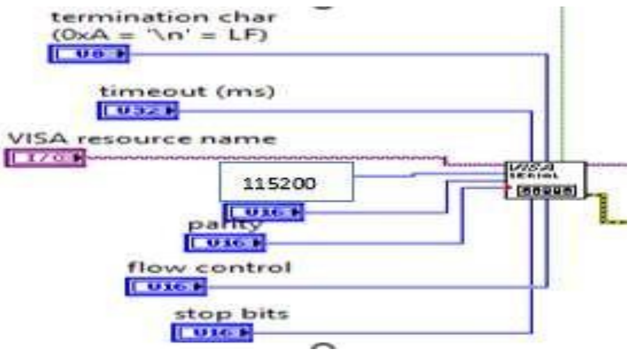

Figure 2: VISA tool LabVIEW

2.3. Control the sensors' reading frequency:

The flowchart of figure 3 shows how to speed up and slow down the reading rates of all channels types. The writing/ reading rate is controlling by an Arduino Uno code. Controlling the speed of the sensor is necessary because the system is multi-channel. The multi-channel system needs good regulation and control because it is multi-channel and different in the types of sensors connected to it. Moreover, because the system is connected to it a large number of sensors such as DHT11, DS18B20, PIR Motion, pulse sensor. However, the octet channels principle of operation is depicted in figures 3 , 4 (flowchart).

2.4. Smart monetary management:

Data writing of this system includes, in addition to the data saving, it has the date and time feature. The instantons data to prevent data duplication, the reading from the sensors is compared to the prior reading. Controlled writing or waiting for a fresh reading procedure yields comparison finding. In other words, the choice to save (write) data is based on the circumstances surrounding data modification. A spreadsheet containing CSV files has the updated data written.

2.5. Publication methods:

Global variables are LabVIEW objects that are pre-built. LabVIEW automatically builds a custom global VI with a front panel but no block diagram when you add a global variable. To specify the data types of the global variables it includes, add controls and indicators to the global VI's front panel.

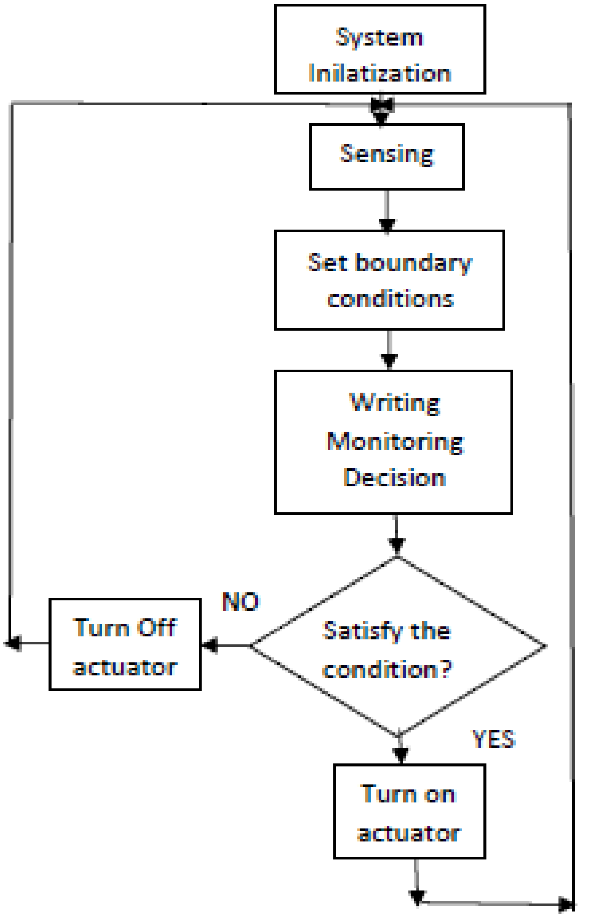

Figure 3: Arduino controller speed up/down procedure

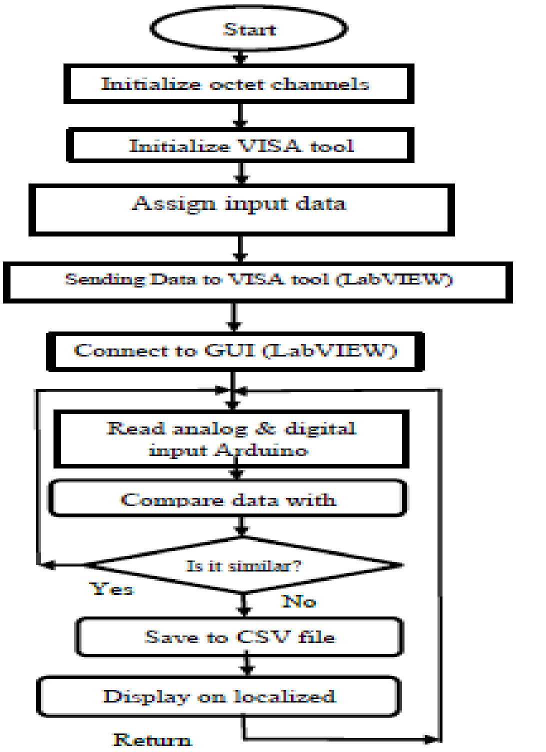

Figure 4 : system operation flow

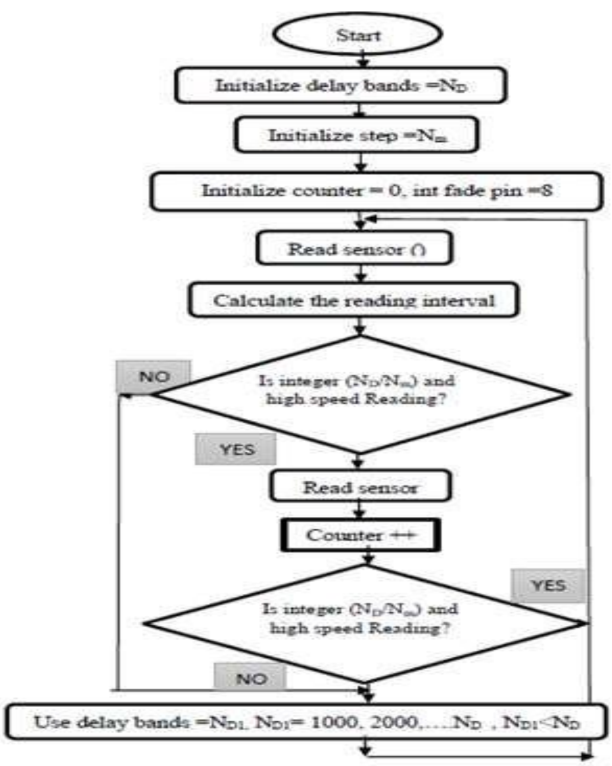

Figure 5: Saving system flow chart

2.5.1. Data Publishing Using the Internal Web Server of LabVIEW:

One can publish the front interface of the project application using the LabVIEW built-in Web Server. Safe, remote-use front panel that is accessible from desktops or mobile devices is created by the LabVIEW Web Server. The URL created using the LabVIEW tools menu is shown in Figure 6.

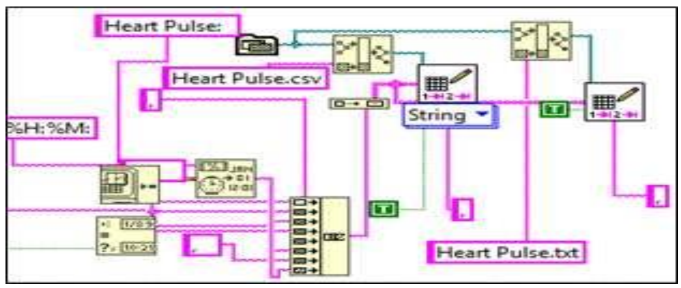

Figure 6: LabVIEW screen

4. Experimental Work:

The experimental work will be demonstrated as follows:

4.1. System Description:

The Arduino-Uno & Rasperry-pi board are connected to the three DHT11 humidity sensors [6], pulse sensors [7], three DS18B20 [8], and PIR motion sensor [9]. The Arduino kit has a designed micro-C preloaded on it. The octet channel operation is managed by a created LabVIEW programme, as illustrated in figure 7, which also shows two monitoring options: local monitoring and remote monitoring.

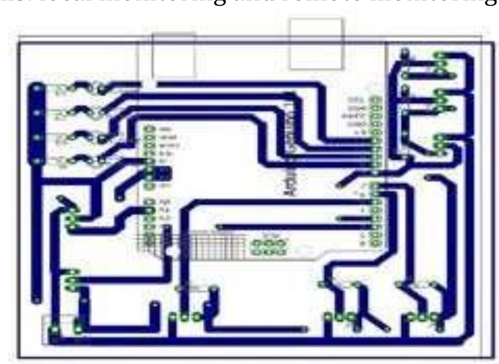

Figure 7 : Circuit layout of the system

Local monitoring is performed using LabVIEW's front panel, while remote monitoring is performed using the developed website [10,11]. After implementing the circuit layout of the system on the PCB board, the final circuit shown in figure [7.8].

Figure 8 : Final circuit of the system

- the next figure is Schematic diagram of circuit:

4.1. System GUI (LabVIEW):

The system GUI has been developed and presented as follow

4.1.1. The DS18B20 temperature & DHT11 Humidity.

Pins 5, 6, and 7 of the GPIO, which are initialised to DHT11_1 & DHT11_2 & DHT11_3 accordingly, will be used to connect the temperature sensor. Pin 3 of the GPIO is initialized to DS18B20_1 & DS18B20_2 & DS18B20_3 (1-Wire technology). Laboratory View has evolved to integrate with and manage the eight channels for both monitoring and the adequate reaching (actuator).

4.1.2. Pulse sensor (heart rate).

Information on the serial transfer using the VISA tool from Arduino to LabVIEW. LabVIEW and any other device can communicate with each other via the Visa protocol. The serial screen receives sensor information at a 115200 baud rate. On the LabVIEW's front panel, graphic representations of the four separate criteria for temperature, movement, humidity, and heart rate may be seen. The heart rate discovered by figure 10's control window.

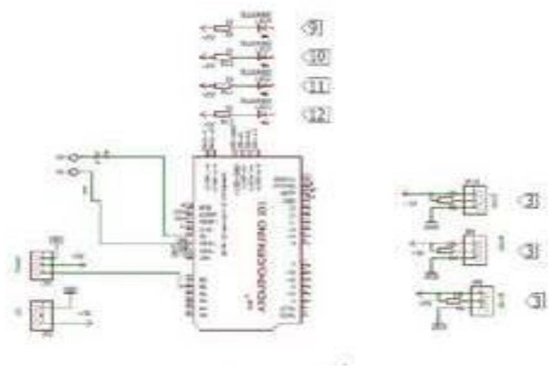

Figure 9 : Schematic diagram of circuit

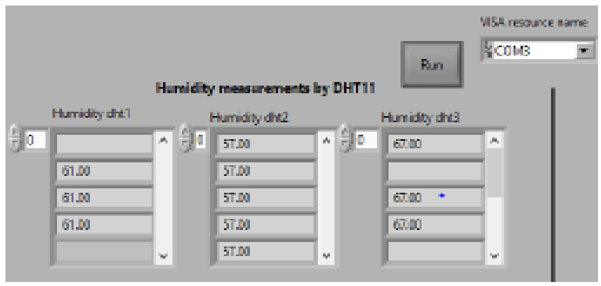

Figure 10: LabVIEW heart rate detection

4.1.3. Motion detection interface:

When the PIR detects motion, it uses the visa tool to transfer the serial data from the Arduino to LabVIEW. The Visa tool is a protocol that enables communication between LabVIEW and any other device that is connected to an Arduino Uno and works at 115200 baud-rate before the serial screen date. On the LabVIEW's front panel, four separate criteria for temperature, movement, humidity, and heart rate were visually shown. Through the control window of Figure 11, the movement detection is obtained. This work integrates the channels of reading octet difference environmental parameters as a general-purpose interface as shown in figure 11.

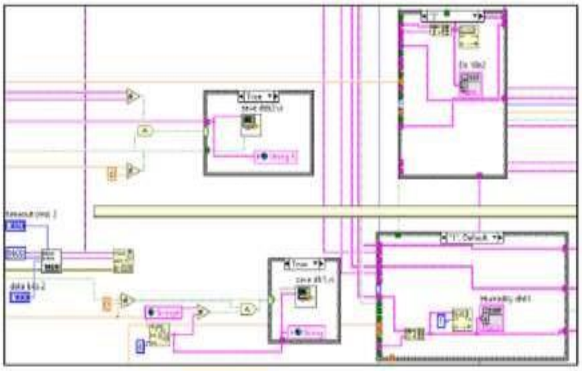

Figure 11. : LabVIEW DHT11 & DS18B20 block diagram.

5. RESULTS AND ANALYSIS

The Results of this work can be classified into three different modules:

5.1. Monitoring modules

The system data reading will be presented as follows:

5.1.1. Temperature and humidity readings

The system designed to read three temperatures degrees sequentially (0.3s apart), the difference between the sensors readings and data the delay band of the measurements as well as the higher resolution of reading (two decimals).

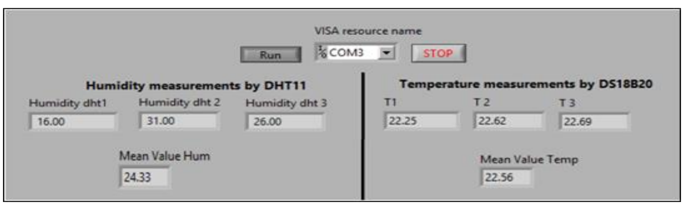

Figure 12: Three-DS18B20 OUTPUT GUI

5.4. Application:

Figure 13: Three DHT11 and three DS18B20 ON Time data.

5.1.2. Heart rate:

The heart rate of the system shown in figure 14 of the local machine and figure 15 for the published web ON time and show data LIVE during program play.

Figure 14: Heart Rate output GUI.

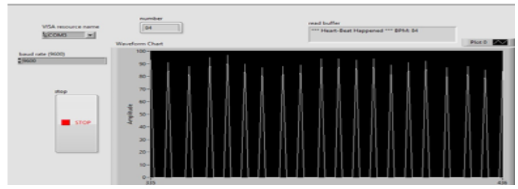

Figure 15: ON Time Heart rate data

5.2. Data monitoring and logging

This module demonstrates both the suggested effective data storage method and the optimisation speed data that are crucial to the system's intelligence.

Humidity dht2	68	9/30/2018	21:48:09:.244
DSb2	29.31	9/30/2018	21:48:09:.244
Humidity dht3	76	9/30/2018	21:48:09:.744
DSb3	29.25	9/30/2018	21:48:09:.744
Humidity dht3	77	9/30/2018	21:48:12:.412
DSb1	29	9/30/2018	21:48:15:.720

Figure 16: Three DHT11 and Three DS18B20 outputs, (a) per second and b) per millisecond

Humidity dht2	57	4/2/2018	8:52:14 PM
DSb2	22.56	4/2/2018	8:52:14 PM
Humidity dht3	67	4/2/2018	8:52:14 PM
DSb3	22.56	4/2/2018	8:52:14 PM
DSb1	22.44	4/2/2018	8:52:15 PM

5.3. System Smart Saving

The difference between the general saving and smart saving, the general saving is saving every reading monitored from the sensor but the smart reading is saving only the new value and not saving the duplicate reading. The system is turned on for 15 minutes for the general and smart methods, then the results are: The size and space for the smart saving file are (5KB) lower than the size and space for the general saving file (59K) as shown in the next figure.

Dht general saving	6/15/2019 1:25 AM	Microsoft Excel C...	59 KB
Dht smart saving	6/15/2019 1:08 AM	Microsoft Excel C...	5 KB

Figure 17 : System Smart Saving

GUI for the experimental result of the motion detection. When any motion happen in front of the sensor, the led will be turned ON (motion detected) until the motion end then the led will be turned OFF. The system designed to read the motion sequentially (0.1 s apart).

The next three flags from the DS18B20 sensor:

In programming the temperature DS18B20 sensor, making an output port. The output port is pin 10, 11, 12 in Arduino-Uno board. Pin 10 is connected to yellow led, which ON as shown in figure 5.32 when the temperature is between (30-10) oC like (Fan). Pin 11 is connected to green led, which when the temperature is low until 10 oC like (Heater). Pin 12 is connected to red led which ON when the temperature is high over 30 oC like (compressor).

Figures 18: show the results of application

4. Conclusion

Through serial connections, an Arduino-Uno has been used to measure, process, store, and react to temperature, humidity, motion detection, and heart rate. Viewing the data using LabVIEW using the Visa instrument, which enables real-time online presentation. Only the unique measurements are stored in the CSV file that contains the recorded data. The system's graphical user interface (GUI) displays this data, which have been saved in system memory. It has been completed to read at a rate that is accurate, effective, and different. In fact, the obtained data changes directly affect how much data is stored. If the same parameters, such temperature, can be monitored simultaneously, then it is legitimate to increase data accuracy in the case of, for instance, temperature and humidity. Multiple inputs of the same measured parameters are validated by the system to either increase system capabilities or data accuracy. This collected data will be sent instantly once the LAN system is connected. The major characteristics of the Smartness system are more effective data storage and faster data playback. Further work for these application : Future Work are Simplifying the interface circuits by using FPGA , Increase the system functionalities by using near expected different sensors ,Merging such systems in the wider industrial applications , Health care. , Smart home and Cathodic protection for petroleum pipes.

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