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Development of Low Cost Monitoring Data Logger Fluid Temperature via Wireless System

Zarith Liyana Zahari[1]
Mohd Azraie Mohd Azmi[1]
Muhd Khairil Najib Johari[1]
Department of Electronic,
Universiti Kuala Lumpur
British Malaysian Institute,
Gombak, 53100 Selangor, Malaysia[1]

Rafiuddin Abdubrani[2]
Department of Process Measurement and Control,
Agar Corp Sdn Bhd, 56000,
Kuala Lumpur, Malaysia[2]

***Abstract*— In this project the development of low cost monitoring data logger fluid temperature via wireless system will be develop in two major parts which is hardware part and software part. There are seven part of hardware circuit. It consists of voltage regulator circuit, UART circuit, microcontroller ATMega 328P circuit, wireless connection circuit using wireless HC-11 434MHZ device, temperature connection circuit, DC motor circuit, heater and relay circuit connection. Transducer DS18B20 used for temperature detection device. The microcontroller will be program using C language to convert the data by using data conversion process and load by using UART cable. A Visual Basic is for Graphic user interface (GUI) to monitoring the fluid temperature value and Microsoft excel as a database medium to record the data from the sensor for every five second.**

Keywords— ***C language, DS18B20,GUI, Microcontroller ATMega 328P, Visual Basic, UART, Wireless HC-11 434MHZ device.***

I. INTRODUCTION

In engineering and industrial world, enhancement of technology will run by each of minute for improved our life become easier. New system of monitoring be required to facilitate the daily work to improvise the production and quality in industry field. Development of low cost monitoring data logger fluid temperature via wireless system is one of the enhanced project in engineering technology. This design used ATMega 328P microcontroller as main processor device supported with other circuit. The microcontroller will process the transmission and receiver data inside the memory. The proses of this design, is more depending on signal condition. The selection of transducer device also reflect the precision of reading and process transmission data. Stabilization of communication interface is important to produce the expected output result. The system collect ambient temperature timely, display graphics on the computer and store a certain amount of temperature data. In additional, the design combine watchdog monitoring circuit with lower power consumption, lowering the system power can improved the reliability of the system [1].

Data acquisition (DAQ) is the process by which physical phenomena from the real world are transformed into electrical signals that are measured and converted into a digital format for processing, analysis and storage by a computer [2]. Normally, it consist of acquisition hardware and input storage. The advancement in electronic and Intelligent Circuit (IC) technology has spawned a new platform in the DAQ system, microcontroller DAQ is very popular and still being used because of its low-cost [3].In this project, applied DAQ as a main interfaced device to communicate between the transducer and expected result display. Many application are use plug-in boards to require data and transfer it directly to computer memory.

A temperature remote monitoring embedded system platform is designed in the paper. And the embedded microprocessor AT91SAM7X256 is used as CPU of the system. The system realize real-time remote data collection monitoring and storage through protocol data conversion of the CAN bus and RS232 bus of the distribute temperature acquisition node [4]. As operating increases, circuit performance degrades rapidly. Digital parts develop an additional threshold shift and more propagation delay. At those temperatures, noise margin for logic levels are reduced and flip flop may no longer function due to timing violation [5].

II. RELATED WORKS

The simultaneous web-based real-time temperature monitoring using multiple wireless sensor network implement two level of communication method which are Wireless Sensor Network (WSN) and Web server sub-system for controlling the WSN and processing the result data from the WSN. The first level of the system, the WSN is composed of a base station and several data loggers. These data-loggers transmit data via wireless RF to the base-station which in turn can be contacted over a GSM network via a GSM modem. The data is comprised of the logger identification number, an analogue- to-digital converter (ADC) value, the time and finally the date. Second level is the sub-system for controlling the WSN and processing the resulting data from the WSN. This is largely done via the web interface which controls the interaction with the base-station and gathers the data from the data-based station into a local database. The connection between the web interface and the base-station is via a GSM network. During a trial the data on the data-station can be retrieved automatically at a user defined interval. Generally, data was transferred to the server at 15 minute intervals. The temperature value is passed to the sub-system as an ADC value and from this web-server calculates the temperature value before storing the data in local database. Aside from requesting data download, the server can set or check the base station real-time clock, purge all data within the EEPROM (performed after a successful download) and check the battery voltage [6]. The particular challenge

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during development process of smart temperature monitoring for data center energy efficiency is managing energy and environmental factor in data centers. Currently, temperature sensor are more used to monitor data center temperature and give alarms for hot spots. Whenever there are hot alarmed, cooling system will increase its cooling supply to eliminate them. Without knowledge of actual cooling need of each equipment in data centers Computer Room Air Conditional (CRAC) quite often significantly oversupplies as a result some positions for example the bottom of racks are extremely cold. Although hot spots can be eliminate, huge amount of energy is wasted. It shows in figure 1 below [7].

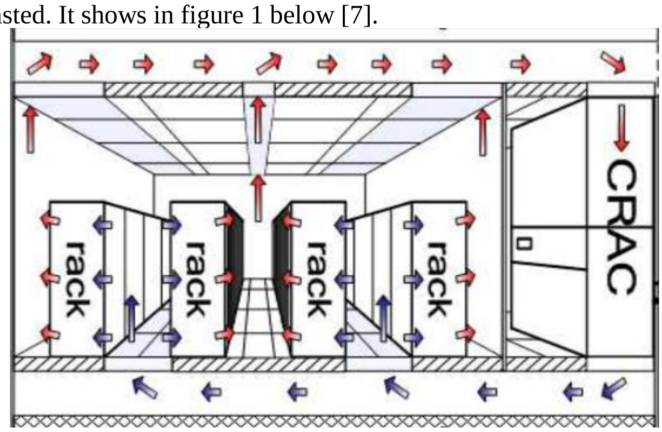

Fig 1: Typically cooling system in data centers

In wireless temperature sensor used three basic chips (DS18B20, CC2420, MCU AT89S52) to design a novel Wireless Temperature Sensor Network (WTSN) via the ZigBEE technology [8]. The WTSN has merits regarding the high detection precision, low power consumption, high cost performance and high reliability thus efficiency applying for the practical temperature testing. The WSTN consist of several temperature sensor, and they aim to initially collect environmental temperature. The temperature information is transferred to ZigBee substation and finally to the center node and the further computer [9]. Figure 2 shows temperature probe's hardware and design of the new WTSN.

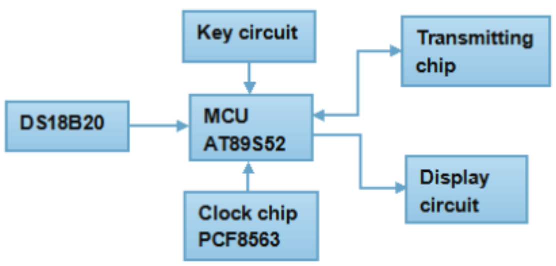

Fig 2: Temperature probe's hardware and design of the new WTSN

Description of figure 2 above is the temperature probe system consists of six parts. In contrast to it, the substation has the same hardware composition but different software deswign. In fact, the probe data information is gathered by temparature sensor DS18B20 is transmitted to MCU AT89S52, is displayed by LED,and is sent by wireless chip CC2420. However, substation's data information is received by CC2420 is then send to MCU AT89S52 and displayed by LED after being unpacked.

III. METHODOLODY

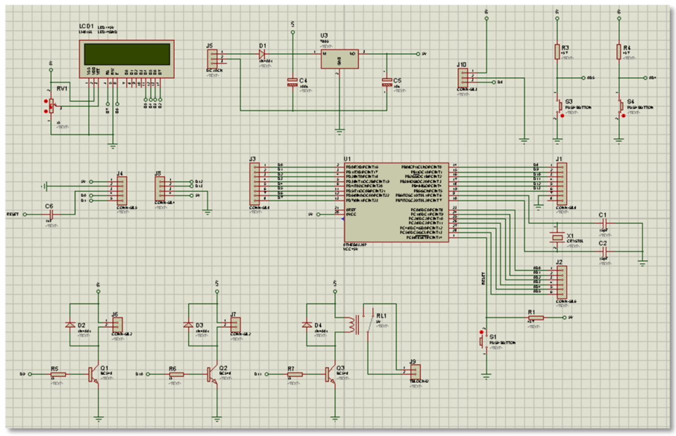

Fig3: Project Schematic layout

Figure 3 above shows the project schematic layout for development of low cost monitoring data logger fluid temperature via wireless system. This project designed using transducer DS18B20 as a sensor to detect the temperature of fluid. The transducer is a small thermometer build with 12bit ADC (Analogue Digital Converter). The measurement from the sensor temperature will convert to the voltage. ATMega 328P microcontroller works as a processor to process and trigger from voltage value to temperature value supported by ADC inside the microcontroller board. As the conversion value must be read after reading-pin state for 8 times and position and store data must be moved, so time spend much in reading one point of data system by every time. If data temperature test system is large-scaled, the system loss caused by it is rather much. And then the alternated test speed of the system decrease obviously, which is influence the efficiency of the multipoint temperature test system seriously [10]. The wireless implementation in this project is for intermediation communication between the microcontroller and visual basic. Visual basic software used to apply GUI (Graphic User interface) to control and monitoring the temperature of fluid. In the proposed system the temperature inside a box is maintained at some desired set-point value, within neutral zone limits, using two state controller mode [11]. For this project, the screen display has appear the current temperature, status of heater and status of cooling fan. In hardware part, the output used LCD, Heater, DC Motor for heater, DC Motor for stirrer and wireless router.

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IV. SYSTEM DEVELOPMENT

4.1 Hardware system design

Figure 4 below shows the explanation of hardware process in flow chart diagram. Start of project, the sensor temperature will detect the current temperature of fluid. For example, the current temperature of fluid is 29 degree Celsius. The range of the temperature is set from 30 degree Celsius to 40 degree Celsius. The current temperature is below than the temperature range, the heater will on and display 1 at the LCD display. The heater automatic turn on and cooling fan is off until achieve the temperature range. Other example, the current temperature of fluid is 41 degree Celsius. The heater is off and display 0 at the LCD display. The cooler fan turn on while the heater turn off until the temperature decrease until arrived the temperature range. Reset button is for stop the project operation.

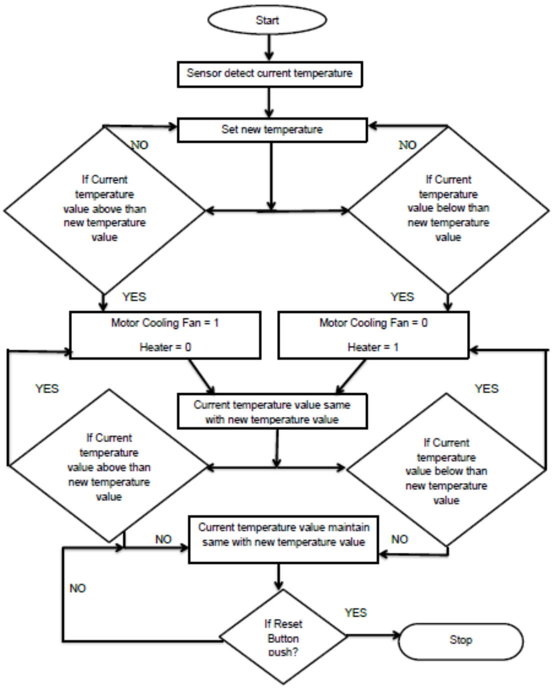

Fig4: Explanation of hardware process in flow chart diagram

4.2 Software system design

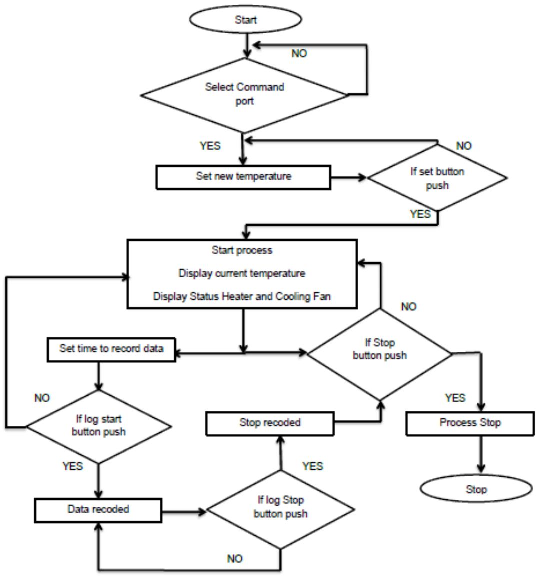

Fig 5: Explanation of software process in flow chart diagram

Figure 5 above shows the explanation of software process in flow chart diagram and figure 4 is a part of communication coding for port recognition. In software system design required to select the command port to for activated the communication between wireless module ports to serial port at personal computer. The example coding is attach at figure 6 below. After the communication interface success, wireless module send the signal to the microcontroller. Real time of the temperature current, heater and cooling fan status will display at the personal computer. The user may adjust the temperature range for test the heater and cooling fan condition. Others, data of the current temperature can be recorded every 5 second. All the data will record at the Microsoft Excel.

```
pcPort = IO.Ports.SerialPort.GetPortNames()
For i = 0 To UBound(pcPort)
    cbxPort.Items.Add(pcPort(i))
Next
```

Fig 6: Part of communication coding for port recognition

V. EXPERIMENTAL RESULT

Result for first experiment shows in figure7 and figure8. Limit of temperature is to 40 degree Celsius. LCD display shows current temperature is 40 degree Celsius. If the temperature in limit then heater and fan display 0. 0 value means the device in deactivated condition.

Fig 7: LCD result display for first experiment

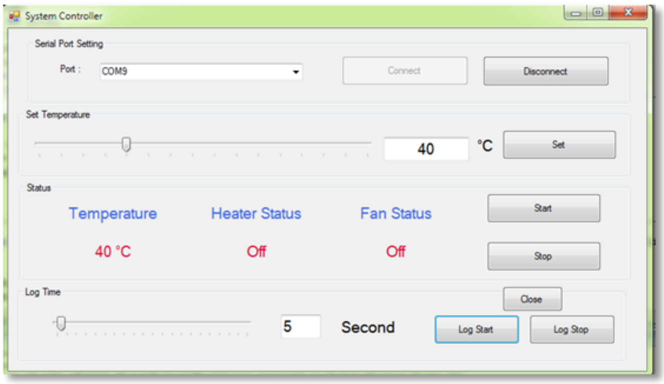

Fig 8: GUI result display for first experiment

Result for second experiment shows in figure 9 and figure 10. Limit of temperature is to 40 degree Celsius. LCD display shows current temperature is 32 degree Celsius. Current temperature is below 40 degree Celsius. If the temperature in below then heater will display 1 and fan display 0. So, the heater is in activated condition and cooling fan is in deactivated condition.

Fig 9: LCD result display for second experiment

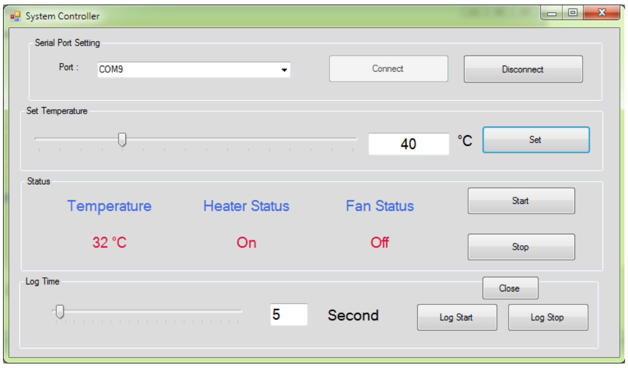

Fig 10: GUI result display for second experiment

Result for third experiment shows in figure 11 and figure 12. Limit of temperature is 28 degree Celsius. LCD display shows current temperature is 31 degree Celsius. Current temperature is above 28 degree Celsius. If the temperature in above then heater will display 0 and fan display 1. So, the heater is in deactivated condition and cooling fan is in activated condition.

Fig 11: LCD result display for third experiment

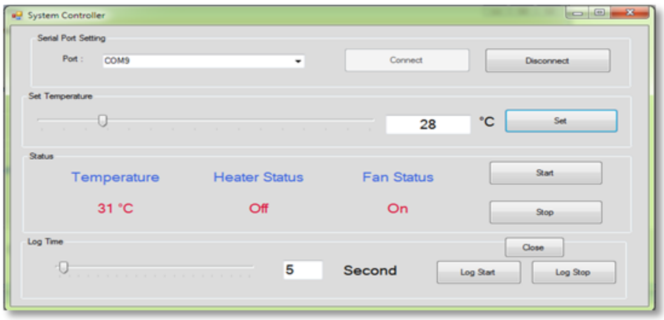

Fig 12: GUI result display for third experiment

In this project, temperature value will save in table if log button is press. The data may save from start pressing log start and stop save the result if user press log stop. Example data of this project shows in table 1 and figure 12. For table 1, data been shown in table format and figure 12 result shows in graph format.

Table 1: Data of fluid temperature

Date & Time	Fluid Temperature, C
20/11/2015 3:39:09AM	30
20/11/2015 3:39:14AM	31
20/11/2015 3:39:19AM	32
20/11/2015 3:39:24AM	34
20/11/2015 3:39:29AM	37
20/11/2015 3:39:34AM	37
20/11/2015 3:39:39AM	37
20/11/2015 3:39:44AM	38
20/11/2015 3:39:49AM	39
20/11/2015 3:39:54AM	39
20/11/2015 3:39:59AM	40
20/11/2015 3:40:04AM	40
20/11/2015 3:40:09AM	41
20/11/2015 3:41:04AM	41
20/11/2015 3:41:09AM	41

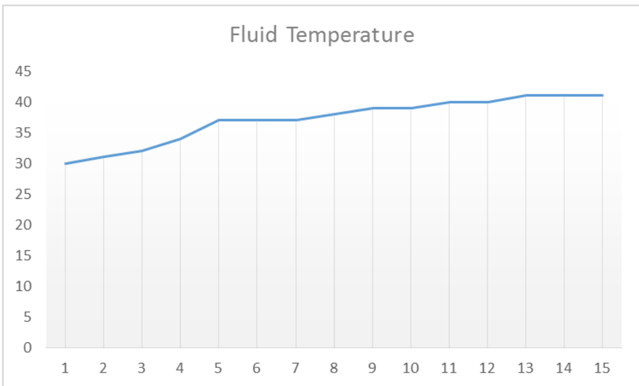

Fig12: Graph of fluid temperature

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VI. CONCLUSION

Development of low cost monitoring Data logger fluid temperature via wireless system use the application programming interface between hardware part and software part. The purposes of the hardware function as the device to detect the temperature and software part function as mediation communication. The development of communication and interfacing part is an important part for this project where it will affect the real time system since this project is using wireless system. It required two module of wireless set for intermediation between computer and microcontroller. All temperature value is display in table, graph and GUI format.

REFERENCES

[1] Z. Yu, W. ZhiShan, and L. JinHua, "Design a Wireless Temperature Measurement System Based on NRF9E5 and DS18B20," *Measuring Technology and Mechatronics Automation (ICMTMA), 2010 International Conference on*, pp. 910-913, 2010.

[2] J. Park and S. Mackay, "1 - Introduction," *Practical Data Acquisition for Instrumentation and Control Systems*, J. P. Mackay, Ed., ed Oxford: Newnes, pp. 1-12, 2003.

[3] T. Sumphao, C. Thanachayanont, and T. Seetawan, "Design and Implementation of a Low Cost DAQ System for Thermoelectric Property Measurements," *Procedia Engineering*, Vol. 32, pp. 614-620, 2012.K. Elissa, "Title of paper if known," unpublished.

[4] Q. Zhu, D. Zhu, and X. Su, "Distributed remote temperature monitoring and acquisition system based on CAN bus," *Prognostics and Health Management Conference, 2010. PHM '10.*, pp. 1-4, 2010.

[5] S. Fong, "A PWM controller for extended temperature applications," *Applied Power Electronics Conference and Exposition, 2000. APEC 2000. Fifteenth Annual IEEE*, Vol. 2, pp. 791-795, 2000.M. Young, The Technical Writer's Handbook. Mill Valley, CA: University Science, 1989.

[6] J. Hayes, K. Crowley, and D. Diamond, "Simultaneous Web-based real-time temperature monitoring using multiple wireless sensor networks," *Sensors, 2005 IEEE*, p. 4 pp, 2005.

[7] Q. Junmei, L. Li, L. Liang, T. Yuelong, and C. Jiming, "Smart temperature monitoring for data center energy efficiency," *Service Operations and Logistics, and Informatics (SOLI), 2013 IEEE International Conference on*, pp. 360-365, 2013.

[8] J. P. Amaro, R. Cortes, #227, F. J. T. E. Ferreira, and J. Landeck, "Device and operation mechanism for non-beacon IEEE802.15.4/Zigbee nodes running on harvested energy," *Ad Hoc Netw.*, Vol. 26, pp. 50-68, 2015, 2015.

[9] X. Fang, "Wireless temperature sensor network based on DS18B20, CC2420, MCU AT89S52," Communication Software and Networks (ICCSN), 2015 IEEE International Conference on, pp. 294-298, 2015.

[10] P. Li, Y. Zhou, Z. Xiangjun, and T.-f. Yang, "A Design of the Temperature Test System Based on Grouping DS18B20," *Industrial Electronics and Applications, 2007. ICIEA 2007. 2nd IEEE Conference on*, pp. 188-191, 2007.

[11] K. Prema, N. S. Kumar, and K. A. Sunitha, "Online temperature control based on virtual instrumentation," in *Control, Automation, Communication and Energy Conservation, 2009. INCACEC 2009. 2009 International Conference on*, pp. 1-4, 2009.