



TERAKREDITASI INSTITUSI B
SK NO. 229/BAN-
PT/AKRED/PT/IV/2015

UNIVERSITAS MUHAMMADIYAH SIDOARJO

DIREKTORAT RISET DAN PENGABDIAN MASYARAKAT

Alamat: Jl. Mojopahit 666 B Sidoarjo 61215, Telp. 031-8945444 psw.130, Faks. 031-8949333

Email: lppm@umsida.ac.id, Website: lppm.umsida.ac.id

Surat Keterangan Tidak Plagiat [Kepangkatan]

Nomor: 516.2/II.3.AU/14.00/C/KET/I/2022

Kepada Yth :

Ibu Indah Sulistiyowati, ST. MT

Di

Tempat

Assalamua'alaikum Wr. Wb.

Sehubungan dengan adanya permohonan Surat Keterangan Tidak Plagiat dengan rincian:

Judul Artikel : Smart Laboratory Based On Internet Of Things In The Faculty Of Electrical Engineering, University Of Muhammadiyah Sidoarjo
Nama Pemohon : Indah Sulistiyowati / Teknik Elektro
URL Sinta Pemohon : <http://sinta.ristekbrin.go.id/authors/detail?id=5996233&view=overview>
Nama Penulis : Indah Sulistiyowati
Tujuan : Kepangkatan
Tujuan Kepangkatan : Lektor

Naskah Yang Dimohonkan pengecekan:

<http://dosen.umsida.ac.id/modul/publikasi/filesktp/210400/sktp-18-01-2022%2003:06:24-210400.pdf>

Artikel tersebut DAPAT digunakan untuk proses kepangkatan.

Demikian surat keterangan ini kami sampaikan, mohon untuk digunakan sebagaimana mestinya.

Wassalamu'alaikum Wr. Wb.

Mengetahui,
Wakil Rektor 1
Universitas Muhammadiyah Sidoarjo


Hana Catur Wahyuni, ST., MT

Direktur DRPM

Universitas Muhammadiyah Sidoarjo


Dr. Sigit Hermawan, S.E., M.Si

sktp-18-01-2022_03_06_24- 210400

by Indah Sulistiyowati St. Mt

Submission date: 19-Jan-2022 10:06AM (UTC+0700)

Submission ID: 1743902755

File name: sktp-18-01-2022_03_06_24-210400.pdf (767.89K)

Word count: 3062

Character count: 15477

PAPER · OPEN ACCESS

Smart Laboratory Based On Internet Of Things In The Faculty Of Electrical Engineering, University Of Muhammadiyah Sidoarjo

To cite this article: Indah Sulistiyowati *et al* 2020 *IOP Conf. Ser.: Mater. Sci. Eng.* **874** 012007

View the [article online](#) for updates and enhancements.

You may also like

- [Environmental Sensor Design Prototype for Genset Backups Power at Ground Station and Data Centers Based on Internet of Things Devices](#)
A Hidayat, P R Ramadhan, Zainuddin et al.
- [Design and Research of Marine Nuclear Power Platform Engine Room Ventilation System](#)
Meikui He, Qian Liu, Ting Gui et al.
- [The Concept and Implementation of Smart Room using Internet of things \(IoT\) for Cost Efficiency and Room Security](#)
R Y Endra, A Cucus and F N Affandi

Smart Laboratory Based On Internet Of Things In The Faculty Of Electrical Engineering, University Of Muhammadiyah Sidoarjo

Indah Sulistiyowati, Arif Rachman Sugiarto, Jamaaluddin Jamaaluddin

Universitas Muhammadiyah Sidoarjo, Sidoarjo, Indonesia

Abstract. Technology continues to grow from year to year that aims to facilitate human work or automation of a system. In this case, the concept of smart laboratory is applied in the laboratory room of Electrical Engineering Faculty of Muhammadiyah University of Sidoarjo by utilizing temperature sensor. This application is used to determine the room temperature as well as the proximity sensor to know the person entering and exiting the room. The sensor is controlled by the NodeMCU microcontroller board to make the system work automatically. For example if someone goes into the room the lights will light up and adjust the temperature with the number of people who are indoors. By applying the internet of things, the system can monitor and control via smartphone updated on realtime firebase databases so that it is not limited by distance because it uses the internet network.

keywords: smart laboratory, NodeMCU, internet of things, firebase,

1. Introduction

The presence of the internet for decades has really revolutionized the way the world works so fast. A new era is at the door, the Internet of Things (IoT) era. Smart devices that will be connected are predicted to reach 20 billion devices worldwide by 2020. Utilization of IoT is expected to be more massive, because IoT is not only talking about devices that are "smart", but also scanning and communication between machines.

The Internet of Things is a technology that innovates surrounding objects with the internet so that everyday activities become easier and more efficient. An easy example is how we can order all electronic equipment in our house to light up or die just by using our voice

In this paper internet of things (IoT) is used to design a smart laboratory. Smart laboratory is one of the technological advances that aims to facilitate human activities by utilizing several electronic devices, so that they can be controlled through smart phone applications [1].

As well as the use of electronic sensors to support an always updated information system and early warning system [2]. With this system, the use of electrical power can be controlled by turning off unused electronic equipment with actuators that are integrated with sensors and smartphone applications, so that it can reduce the electrical power load used [3]



Content from this work may be used under the terms of the Creative Commons Attribution 3.0 licence. Any further distribution of this work must maintain attribution to the author(s) and the title of the work, journal citation and DOI.

At present, technological developments are also expanding in the field of communication, this can be seen from the number of internet usage from year to year [4]. One of them is Internet of Things technology. With the application of internet technology of things (IOT) where all electronic equipment or microcontrollers as a control of sensors and actuators can be connected to the internet so that they can be controlled or controlled from anywhere and anytime as long as they can connect to the internet. This is very useful for people who often leave the room for a long time or who are not able to indulge freely in the room [5]. The smart laboratory concept here is the efficiency of electricity use in air conditioner (AC) devices, by applying the working principle if the number of people in a room is increasing, the temperature of the air conditioner will be cooler and vice versa, if the number of people in the room is less then the temperature of the air conditioner the rising or normal temperature that the user wants. Ultrasound proximity sensor (HC-sr04) is used to calculate the number of people entering or exiting the room by utilizing the distance read by the sensor so that we can calculate the number of people in the room. Where the entire system will be connected to the internet that can be accessed with an android phone so that it can monitor the condition of the room or control the air conditioning temperature of the room via android.

2. Experimental Method

2.1. System Block Diagram

Sensors in this system will sense the conditions that occur on the sensor. Ultrasound HC-SR04 proximity sensor is used as sensing someone in or out of the room, while the temperature sensor is used as temperature sensing to determine the temperature value in the room.



Figure 1. system block diagram

Description:

1. User.
2. Android smartphone.
3. Database (cloud).
4. Temperature sensor.
5. NodeMCU.
6. Arduino Uno.
7. Proximity sensor.
8. Relay module
9. Remote control
10. AC

The sensor will give a value to the Arduino microcontroller which will be processed based on the programmed instructions in it and will work automatically if there is someone entering the room then the lights will turn on and turn on the AC and adjust the AC temperature based on the number of people in the room .

The results of the microcontroller will provide output to the relay module and the remote as an actuator between the control device and the electronic device.

The following functions of each block block diagram above

1. Power supply is needed to provide voltage on the microcontroller for 12 volts DC while the sensor and actuator devices get a voltage of 5 volts DC to function properly
2. The microcontroller in this study uses Arduino Uno as a control center or processing data from sensors. While the nodeMCU microcontroller as access to connect to the wifi network.
3. HC-SR04 proximity sensor is used to detect the number of people entering or exiting by looking at the change in the detected distance value. While the DS18B20 temperature sensor is used to detect the temperature around the room
4. Actuators function as movers or connectors between the microcontroller and the load or equipment that is controlled, for example: remote AC
5. Android is used as an interface display with users so that it is easier and more efficient to perform system controls.

2.2 Flow Chart System

The data obtained by the micro-controller will be uploaded to the firebase database as an internet of thing system so that the value can be accessed again from other devices such as smartphones based on the values contained in the firebase database. Thus smartphone users can control and monitor the condition of the room based on the value and based on the instructions on the smartphone application mentioned. Like the flow chart below

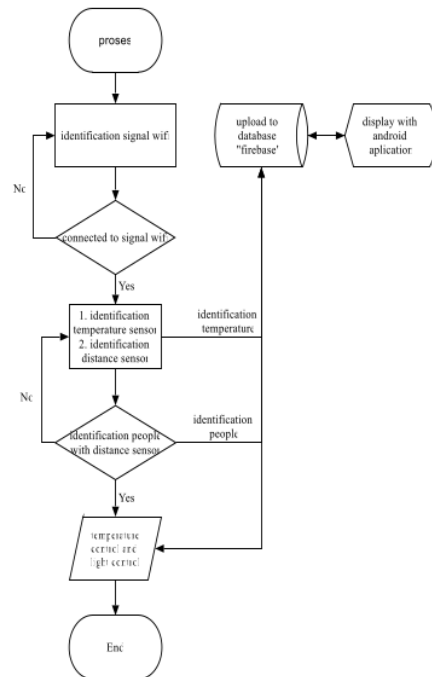


Figure 2. Flow Chart

The flow chart above explains that the system workflow starts by connecting the device to the power supply and the system is ready to process. NodeMCU is connected to the internet as a communication between software and hardware. If the two factors have been met, then the sensor sensor will start

detecting and sensing so that the data will be processed immediately and sent to the server which will be displayed on a smartphone or 16x2 LCD. The next process is if the microcontroller gets the pairing code from android in accordance with the previous program it will activate or deactivate the actuator in the form of a relay, if there is no control from android the microcontroller will process based on the



number of people who have been in the program.

2.3. MIT APP INVENTOR

MIT App Inventor is an open source web application that was originally released or developed by Google, and is currently managed by an institution in the United States called the Massachusetts Institute of Technology. MIT App Inventor is used to create a Sketch program that will become an application for use on Android.

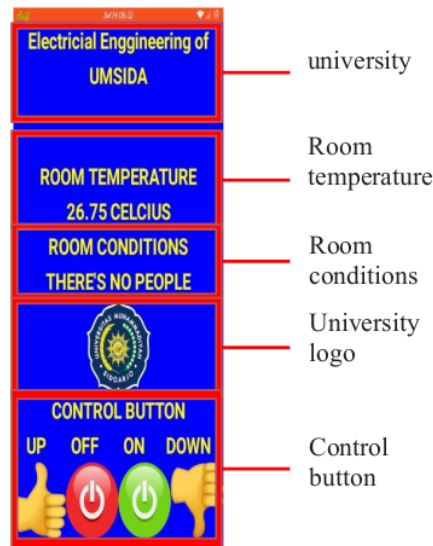


Figure 3. Design android application with MIT App Inventor.

3. Result and Discussion

3.1. Power Supply Testing

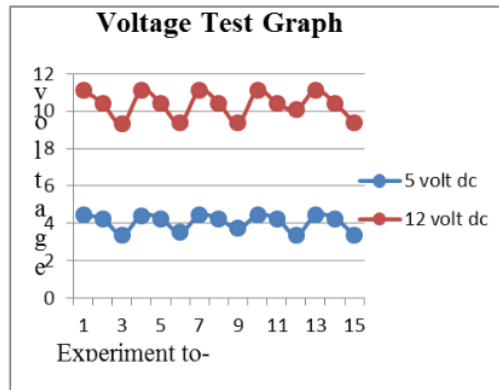


Figure 4. power supply testing chart

Table 1. Power Supply Test Results

Average			Standard Deviasi			Accuracy %		
No burden	Standby load	Peak load	No burden	Standby load	Peak load	No burden	Standby load	Peak load
4.43	4.25	3.47	0.0071	0.0045	0.1518	88.60	85.04	69.40
11.13	10.44	9.51	0.0045	0.0114	0.3253	92.77	86.97	79.25

The power supply voltage has decreased voltage starting from the test without load, standby load and arrived at the peak load caused by conditions where all the devices are working together to supply 2 arduino UNO microcontrollers and MCU nodes, I2C LCDs, relays, indicators and sensors. However, from the test value data has a very small standard deviation value of less than 1 (one), this indicates that the power supply has a very good voltage value stability for supply of equipment so that it can work well without any errors caused by the power supply voltage that is not good.

3.2. LCD TESTING

Table 2. Suitable LCD

Testing	LCD suitability testing with the program to						
	1	2	2	3	3	Average	Standard Deviasi
character	√	√	√	√	√	-	-

From the data value in table 3.2 we can conclude that: LCD can work well and is ready to be used in a system that functions to display information carried out by the microcontroller in the form of a temperature value detected by the DS18B20 sensor and display the number of people who are indoors.

3.3. Testing of HC-SR04 Ultrasonic Distance Sensor

This test is to determine the distance value that is read by the sensor as a scanner for people entering or leaving the room by utilizing the distance that is read then comparing the value of the sensor with a standard measuring instrument that has an accuracy of 1 cm.

The test steps are as follows:

1. Construct the sensor, microcontroller and power supply correctly.
2. Prepare the sensor program and upload it to the microcontroller.

3. Compare the measurement results of sensor values with standard tools.
4. Do it like the following picture and record the results in the table

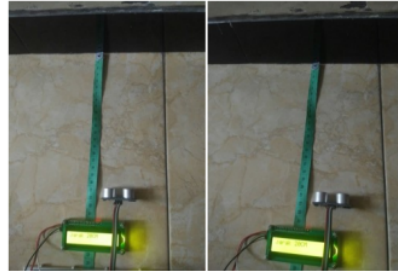


Figure 5. Examples of HC-SR04 ultrasonic testing

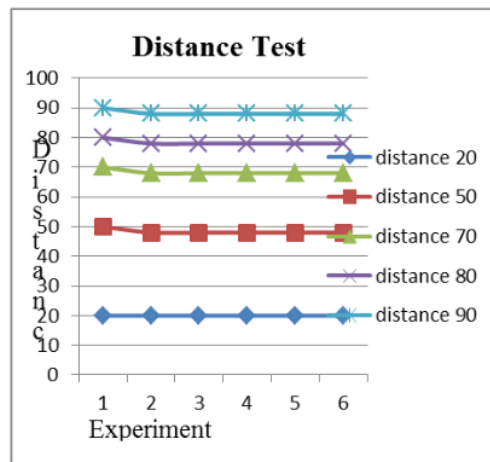


Figure 6. distance sensor testing chart

in testing the ultrasound sensor HC-SR04 has a very good measurement stability when viewed from the standard deviation value. But at a distance of 20cm and above, there is an increasingly large error. In this system the ultrasound sensor is used as an indication of the person who entered or the person who came out through the door with a difference in the measured distance from the ceiling of the door.

3.4. Testing of DS18B20 Sensor with Digital Thermometer Standard Tools

DS18B20 sensor testing is carried out to determine whether the sensor is working properly and then compared to the standard Thermo ONE ALPHA 1 brand temperature sensor (MOH AKD 20901600231).

The DS18B20 sensor testing steps are as follows:

1. Connect the DS18B20 sensor to the NodeMCU Microcontroller pin with the cable to the specified pin.
2. Leave the computer and run the Arduino IDE program, then connect the USB cable to NodeMCU,
3. Then upload the program to measure room temperature

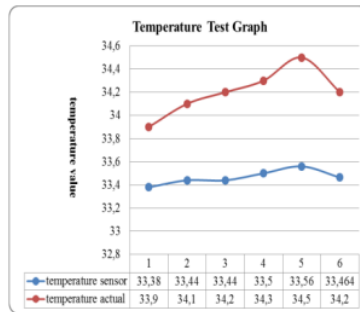


Figure 7. DS18B20 sensor testing chart

3

In testing the DS18B20 sensor with a standard tool ratio there is a difference in accuracy of 0.7 C with an accuracy of 97.85%. on the test value the DS18B20 sensor is good to use as a measurement even this sensor has a smaller standard deviation than the standard tool. This means that this sensor has better stability compared to standard tools

3.5 Overall System Testing

Overall testing of this system aims to be able to see whether the system is running as desired or not. To do the testing process are carried out several stages as follows:

1. Establish the system properly to avoid mechanical errors.
2. Prepare a wifi and internet network so that the microcontroller can be connected as the first condition.
3. Time the time according to BMKG
4. Record and observe the results of the tests that have been carried out

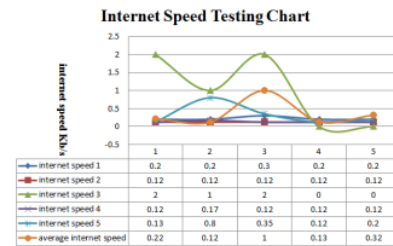


Figure 8. Results of internet speed testing graph

The graph above is a test of the internet speed needed to control and monitor the system

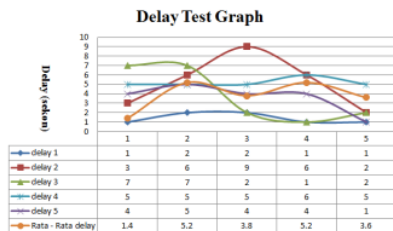


Figure 9. graph testing delay when using the application

The picture above is a graph of testing the delay to update data to the database from the microcontroller.

From the results of several tests that have been done above, the results of the overall tool system testing, starting from a room temperature monitoring system that uses an internet of things system can be monitored without any constraints at a certain distance. By using a temperature sensor DS18B20 which has an accuracy of up to 97% compared to a standard temperature measuring device so as to reduce the value error when monitoring. As well as monitoring the presence of someone or not in the room by using 2 ultrasound HC-SR04 proximity sensors, as well as controlling the temperature conditions in the room of the electrical engineering faculty laboratory so that the laboratory head can monitor the condition of the room.

To support the internet of things system we use the NodeMCU microcontroller because it already includes a wifi module, so that it can connect to the internet network with the wireless system and the android application using MIT APP INVENTOR as an interface to the user. The use of the internet system of things affects several factors, namely the distance and signal strength and network on the smartphone which results in a delay in the monitoring process and the process of controlling the temperature of approximately 3 to 4 seconds against the actual response of the device to the smartphone.

4. Conclusion

1. This system is expected to be able to use a microcontroller that is able to work in multitasking because this tool must be able to control and monitor at the same time.
2. The use of a better program, for example PID to be able to determine the desired temperature set point so that it can work automatically and smartly.
3. Use of internet networks that are good from network strength factors and data rates that are expected to be able to communicate over the network without any interference in the form of time delay.

References:

- [1] F. Masykur and F. Prasetyowati, "Aplikasi Rumah Pintar (Smart Home) Pengendali Peralatan Elektronik Rumah Tangga Berbasis Web," vol. 14, no. 1, pp. 93–100, 2016.
- [2] B. Mikrokontroler, A. Dan, and R. Time, "VOL . 6 NO . 1 Maret 2013," vol. 6, no. 1, pp. 146–162, 2013.
- [3] S. S. Kusumawardani, "PEMODELAN MONITORING PEMAKAIAN DAN PENGHEMATAN ENERGI," vol. 2014, no. Sentika, 2014.
- [4] kominfo.go.id, "penggunaan internet." [Online]. Available: https://kominfo.go.id/index.php/content/detail/3415/kominfo+%3A+pengguna+internet+di+indonesia+63+juta+Orang/0/berita_satker2.
- [5] A. Uno, "Fakultas Teknik – Universitas Muria Kudus 297," pp. 297–302, 2017.
- [6] K. Nasional, I. Sosial, A. Dhiwantara, and B. K. Simpony, "Rumah pintar berbasis mikrokontroler dan android sebagai pengendali," 2016.
- [7] P. Ilmiah, "PURWARUPA SISTEM MENYALAKAN DAN MEMATIKAN LAMPU RUANGAN BERBASIS ANDROID DENGAN WEMOS D1 MINI," 2017.
- [8] Arduino, "Arduino UNO," 2015. [Online]. Available: <http://www.arduino.org/products/boards/arduino-uno>.
- [9] Anonymous, "Handson Technology User Manual V1.2," *Hanson Technol.*, pp. 1–22, 2017.
- [10] kominfo.go.id, "penggunaan internet." [Online]. Available: https://kominfo.go.id/content/detail/4286/pengguna-internet-indonesia-nomor-enam-dunia/0/sorotan_media.
- [11] M. Irsan, P. Studi, T. Informatika, F. Teknik, U. Tanjungpura, and J. Prof, "RANCANG BANGUN APLIKASI MOBILE NOTIFIKASI BERBASIS ANDROID UNTUK Mendukung Kinerja di Instansi Pemerintahan."

- [12] appinventor.mit.edu, “mit app inventor.” [Online]. Available: <http://appinventor.mit.edu/explore/index-2.html>.
- [13] M. Hakimah, “Pembelajaran Embedded System Berbasis Arduino Mega 2560 dan MIT App Inventor,” no. xx, pp. 2–6, 2016.
- [14] E. B. Lewi, U. Sunarya, and D. N. Ramadan, “Sistem Monitoring Ketinggian Air Berbasis Internet of Things Menggunakan Google Firebase Water Level Monitoring System Based on Internet of Things Using Google Firebase,” pp. 1–8, 2016.
- [15] G. Magdalena, A. Aribowo, and F. Ati Halim, “Perancangan sistem akses pintu garasi otomatis menggunakan platform Android,” *Pros. Conf. Smart-Green Technol. Electr. Inf. Syst.*, vol. D-025, no. November, pp. 301–306, 2013.
- [16] Maxim Integrated, “Datasheet DS18B20,” *Maxim Integr.*, vol. 92, p. 20, 2015.

ORIGINALITY REPORT

8%

SIMILARITY INDEX

6%

INTERNET SOURCES

9%

PUBLICATIONS

5%

STUDENT PAPERS

PRIMARY SOURCES

- 1 Arief Wisaksono, Catur Aswar Ragil. "Design and Development of Parking Motor Parking Information System at Muhammadiyah University, Sidoarjo", IOP Conference Series: Materials Science and Engineering, 2020
Publication 5%
- 2 vital.lib.tsu.ru
Internet Source 2%
- 3 Sofyan Radit Kurniawan, Syamsudduha Syahrerini. "The prototype for measuring the height and monitoring of river water quality based on the Internet of Things", Procedia of Engineering and Life Science, 2021
Publication 2%

Exclude quotes On

Exclude matches < 2%

Exclude bibliography On