Journal of Electrical Technology UMY (JET-UMY), Vol. 4, No. 1, June 2020
ISSN 2550-1186 e-ISSN 2580-6823

Simulation of ATMEGA8 Microcontroller-Based Schizophrenia Patient Detector

Erika Loniza*[1], Anugrah Utami[2], Meilia Safitri[3], Yuli Ermawati[4]

[1,2,3]Department of Electromedical Engineering, Universitas Muhammadiyah Yogyakarta
Jl. Lingkar Selatan, Tamantirto, Kasihan, Yogyakarta, Indonesia
[4]Department of Electrical Engineering, Universitas Baturaja
Jl. Ki Ratu Pengulu No. 02031 Baturaja 32215 OKU South Sumatera, (0735) 326122

*Corresponding author, e-mail: erika@umy.ac.id

Abstract – *Schizophrenia is a chronic mental disorder causing sufferers to experience delusions, hallucinations, thoughts distracting, and behavior changes. This condition that usually lasts a long time, is often interpreted as a mental disorder, given the patient's difficulty distinguishing between reality and mind. This study aims to facilitate nurses in providing care, especially in the inpatient room, to make it more intensive using the magnetic sensor as a detector when the door is open, the Passive Infrared Receiver (PIR) sensor as a detection of the patients flew motion and the lamp as an indicator. The data results were obtained from testing by calculating the distance if the sensor could detect. The testing results proved that the magnetic sensor could merely detect up to 1 centimeter, while the PIR sensor could detect up to 5.5 meters.*

Keywords*: Magnetic Sensor, PIR Sensor, ARMega8*

I. Introduction

Schizophrenia is a chronic mental disorder characterized by disturbances of thought, emotion, behavior, illogical thinking, wrong perception and attention, and flat and irrelevant influences. Schizophrenia patients will feel delusions and hallucinations [1]. Schizophrenia can affect anyone, both men and women, in their late teens or young adults. In men, it usually happens between 15-25 years and in women between 25-35 years. It is estimated that schizophrenia affects one percent of the world's population [2]

Based on the results of Basic Health Research (Riskesdas) (2018), the number of people living with schizophrenia in Indonesia reached 450,000 [3]. Access to medication and mental health services is still inadequate in Indonesia. As a result, most of the population in this country, especially in remote villages, is likely to treat people with mental health conditions with improper measures such as retention [4]. To treat schizophrenia, doctors usually combine cognitive behavioral therapy with antipsychotic drugs. To increase the recovery chances, treatment must also be followed by the support and care of the patient's closest people [5]. One of the obstacles to providing optimal schizophrenia treatment is the patients' lateness to check their condition, resulting in delayed treatment, which can be harmful. Relapses frequently happen, causing the treatment increasingly difficult and eventually become chronic [6]. Unfortunately, during the healing period, when patients relapse, they frequently go out unconsciously and endanger others and themselves [7]. In 2017, based on the problems that have been explained in the introduction, this research created a tool that can detect patients if they walk out unconsciously while being treated in the room or care environment [7] and provide more intensive care if there is kidnapping, aiming to assist nurses in handling schizophrenia patients [8].

II. Literature Study

In this study, the authors describe a previous study conducted by Slamet Riyadi entitled "SMS-based Home Door Safety Control System", an entrance security control system. The research design data were obtained from the design test results based on

Manuscript received August 2020, revised September 2020

measurements and observations. The study aimed to develop a security control system equipped with a Mobile phone (HP) used as a Short Message Services (SMS) reader and the modem used as a receiver. This study employed observation, literature, interview, and analysis as the method. This door control research results were expected to be implemented in the original form [9].

Budi's study entitled "Designing of Atmega8535 Microcontroller-based Security System" aimed to design a security system applied to rooms keeping valuable items. This system consisted of a microcontroller used to connect each module and a program to control this module using AVR. This sensor could detect movement when a person entered a room, and the camera would rotate toward that person, record events, send short messages, and activate a sound alarm system. This system worked fine without any serious problems. The problem that could occur was the slow sending of short messages influenced by the crowd level of Global System for Mobile (GSM) service providers. This system could be further developed by adding some features such as automation and system activation. System activation could be developed by changing the RF Remote with Radio Frequency Identification (RFID commonly used for access keys or self-identification) to increase the security system [10].

Schizophrenia is a mental disorder characterized by damage or disruption to thought processes, perceptions, emotions, movements, and behavior. Men have a higher incidence rate than women, with a ratio of 1.4 to 1 [11]. Sufferers frequently experience discrimination, thus making them difficult to interact with other people. As a result, most of them are expelled from school and workplace, divorced, neglected, and even shackled by their families. The shackling is carried out on the pretext of not endangering others or to cover up the family's disgrace [12].

In 2009, Abdul Gayung conducted a study entitled "Home Security System with Security Password Using Motion Sensor Based on Atmega89S51 Microcontroller". Thefts frequently occur, requiring the utilization and optimization of high-level security equipment, including ease and comfort in its users. An alternative security tool in the form of an electronic key using a coded password set could be a solution because passwords as a key provide various facilities with practical forms and use. The electronic password key worked using an infrared sensor as a door movement detector, the Atmega89S51 microcontroller as system control, and several other supporting electronic components. This tool could electronically open and lock the door based on the typed password. The Atmega89S51 microcontroller fully controlled the whole system on the electronic key with a password to enter the house. Moreover, typing a password more than two times would ring the alarm, and if there were an object coming in by breaking, it would sound. For this reason, it is necessary to make a program using an assembler programming language used as a control program of the Atmega89S51 microcontroller [13].

A previous study by Ita Rusmala Dewi entitled "Tele Alarm and Multilevel Security System on an Arduino Microcontroller-based Car," revealed that a car safety device with an unlimited range alarm and a multilevel security system could perform security functions by activating alarms that could be heard at close range, remoting alarms via Short Message Service (SMS), and deactivating the starter and ignition simultaneously. Moreover, car owners could also deactivate and reactivate the system via SMS. This tool employed a microswitch Arduino Uno microcontroller, GSM/GPRS Shields, relay, LED, and buzzer. The testing results from five providers indicated that this tool could respond to illegal efforts against the car well, and the fastest response time to the buzzer was 02.43 seconds with the longest response time of 05.03 seconds, while the fastest response time to SMS was 06.75 seconds and the longest response time was 16.85 seconds. Thus, the car owner could find out immediately if there was an illegal action against the car, even though the car was far [14].

Tri Rahajoeningroem and Wahyudin researched the "Home Security System with Monitoring by Cellular Phone Networks" [15]. In the study, a home security system was designed with monitoring using a cellular telephone network. This tool was designed to ease the homeowners from locking their doors and notifying the door's condition when left empty. The media used was Handphone (HP) by utilizing SMS facilities. This tool consisted of a magnetic switch sensor as an input to notify the door condition to the microcontroller; the microcontroller used was ATmega8535. The keypad functioning as input was a password, and a GSM modem functioning as a sender and receiver of SMS. This security system was successfully built with a working principle of activating a warning by sounding the buzzer and sending a warning SMS in the form of notification text "intruders" to telephone numbers programmed on the microcontroller if there were people who did not have a password entered the house [15].

II.1. Magnetic Sensor (Read Sitch)

Magnetic sensors, also called relays, will be affected and provide changes in the output conditions, like a two-state switch (on/off), driven by a magnetic field around it. These sensors are usually packaged in a vacuum free from dust, moisture, smoke, or steam. This magnetic sensor's mechanism will work when the type of conductor is located or affects a magnetic field, thereby causing the magnet to be attracted or rejected according to the influence given [16].

II.2. Passive Infrared Receiver Sensor

Passive Infrared Receiver (PIR) is an infrared-based sensor. Unlike most infrared sensors, an Infrared Light Emitting Diode (IR LED) and a phototransistor, PIR does not emit anything like IR LED. As the name implies 'passive', this sensor only responds to energy from the passive infrared rays owned by every object it detects. The object that can be detected is usually the human body. In this PIR Sensor, some parts, such as Fresnel Lens, IR Filter, Pyroelectric sensor, amplifier, and comparator, have their respective roles [17].

This PIR sensor works by capturing heat energy generated from passive infrared rays owned by every object with a temperature above absolute zero. It is similar to the human body with a temperature of about 32° Celsius, a typical heat temperature found in the environment. This infrared ray beam is then captured by the pyroelectric sensor, the core of this PIR sensor, causing a pyroelectric sensor consisting of gallium nitride, cesium nitrate, and lithium tantalate to produce an electric current. When humans are in front of the PIR sensor in a stationary condition, the PIR sensor will calculate the wavelength produced by the human body. This constant wavelength causes the heat energy generated to be almost the same in the surrounding environmental conditions. When humans make a move, the human body will produce passive infrared rays with varying wavelengths. Hence, it produces different heat, causing sensors to respond by producing pyroelectric material currents with different magnitudes. The comparator produces output due to these different quantities.

Therefore, the PIR sensor will not produce output if it is confronted with a hot object that does not have an infrared wavelength between 8 to 14 micrometers and a stationary object such as a very bright light beam that can produce heat, reflections of objects from the mirror and heat during the season hot. The PIR sensor distance can be set as needed, but the maximum distance is solely +/- 6 meters, and the minimum is +/- 30 cm [18].

II.3. ATmega8

VCC supplies digital voltage, the magnitude of the voltage ranges between 4.5–5.5V for ATmega8 and 2.7–5.5V for ATmega8L. Moreover, ground reference zero also supplies digital voltage [19].

PORTB (PB7..PB0) is an 8-bit bidirectional I/O port with an internal pull-up resistor that can be selected. This output port buffer has symmetrical characteristics when used as a source or sink. When used as input, externally pull-low pin pulses will emit a current if the pull-up resistor is turned on. PORTB pins will be in a tri-state condition when the reset is on, even if the clock is not running. PORTC (PC5..PC0) is a 7-bit bidirectional I/O port with selectable internal pull-up resistors. This port output buffer has symmetrical characteristics when used as a source or sink. When used as input, externally pull-low pin pulses will emit a current if the pull-up resistor is turned on. PORTC pins will be in a tri-state condition when the reset is on, even if the clock is not running. The PC6// reset, if the RSTDISBL Fuse is programmed, then PC6 functions as an I/O pin but with different characteristics from PC5..PC0.

If the RSTDISBL Fuse is not programmed, then the PC6 functions as the Reset input. The low signal on this pin with a minimum width of 1.5 microseconds will bring the microcontroller to the reset condition, even though the clock is not running. PORTD is an 8-bit bidirectional I/O port with selectable internal pull-up resistors. This port output buffer has symmetrical characteristics when used as a source or sink. When used as input, externally pull-low pin pulses will emit a current if the pull-up resistor is activated. PORTD pins will be in a tri-state condition when the reset is active, even if the clock is not running.

Reset, the low signal on this pin with a minimum width of 1.5 microseconds, will bring the microcontroller to a reset condition, even though the clock is not running. Signals with a width of fewer than 1.5 microseconds do not guarantee a reset condition. AVCC is a voltage supply pin for ADC, PC3..PC0, and ADC7.ADC6. This pin must be connected to the VCC, even if the ADC is not used. If ADC is used, VCC must be connected to AVCC through a low-pass filter to reduce noise [20][21].

III. Research Method

III.1. Diagram Block

The microcontroller obtained a voltage supply from the power supply. Then the microcontroller shared the voltage in each block. Input magnetic signals and PIR sensor signals received by each sensor were forwarded to the microcontroller. Furthermore, it was processed according to the specified program. If the data received by the microcontroller were included in the specified program, the microcontroller would forward the data. Therefore, the data turned on the lights and sounded the buzzer.

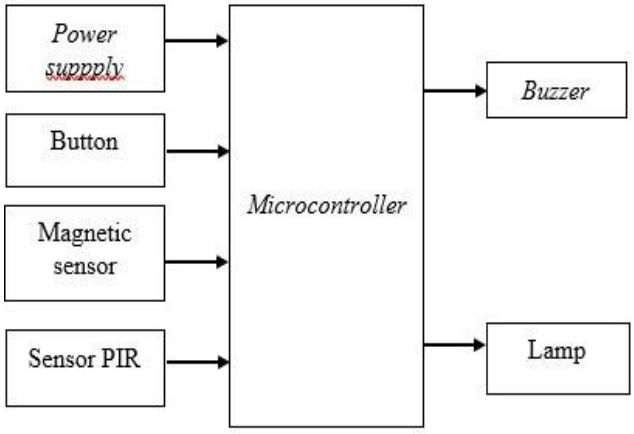

Fig. 1. Block diagram

III.2. Flow Chart

When the device was turned on, initializing was the first thing the microcontroller did. When the user pressed the button, and the patient opened the first door, the situation was safe. However, if the user did not press the button and the patient opened the door 1, the yellow light would turn on and activate the buzzer with a specific time lag, as a state of being alert to specific times and conditions. If the patient did not open the door, the situation would be safe. If the patient had passed the main gate, the buzzer would turn on, and the red indicator light turned on and off with a specific time interval, the danger signal would light up with a state of alert. Conversely, if the patient did not pass through the main gate, the situation would be safe.

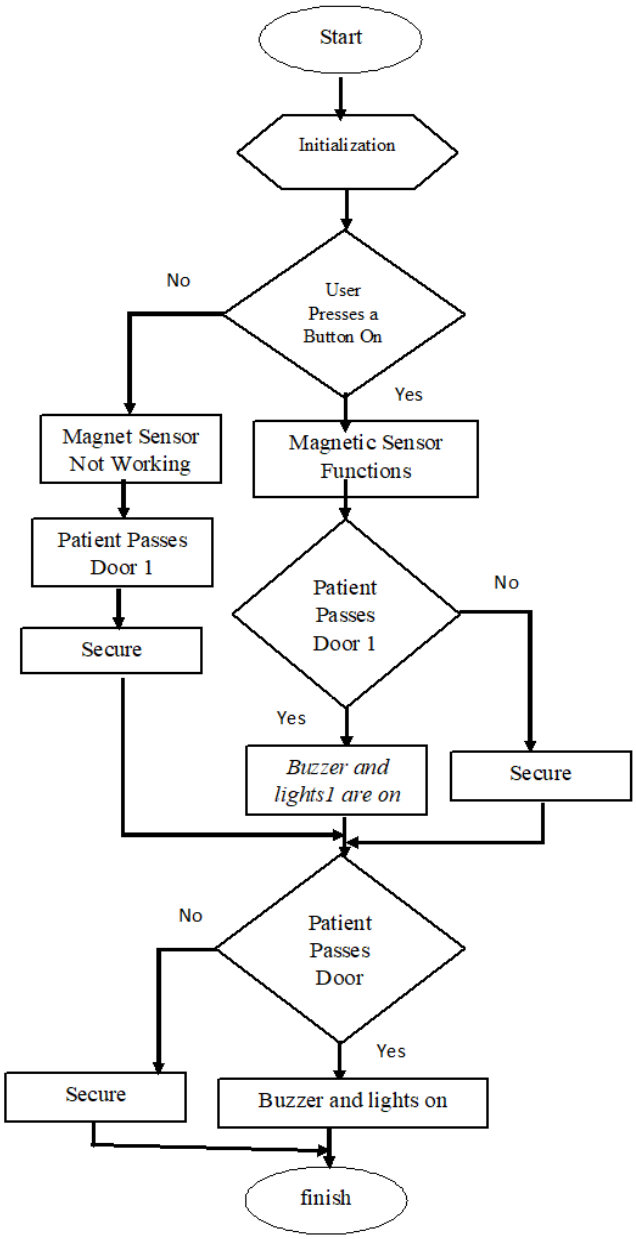

Fig. 2. Flow Chart

IV. Results and Discussion

In distance measurements, researchers measured and monitored by comparing the voltage to activate the state in the on/off position as a comparison. Moreover, researchers also measured the sensitivity of the PIR sensor to human movement by walking horizontally (H) in front of the PIR sensor and seeing variations in the detection distance [22][23]. Table 1 is a voltage comparator description.

TABLE I
SENSOR VOLTAGE COMPARATOR, THE CURRENT OUTPUT VOLTAGE

Sample	PIR Sensor Voltage (cm)		Output Voltage (Volt)		Current (Ampere)		Description	
	H	V	H	V	H	V	H	V
1	50	50	0.72	0.72	0.23	0.23	Active	Active
2	100	100	0.72	0.72	0.23	0.23	Active	Active
3	200	200	0.72	0.72	0.23	0.23	Active	Active
4	300	300	0.72	0.72	0.23	0.23	Active	Active
5	400	400	0.72	0.72	0.23	0.23	Active	Active
6	500	500	0.72	0.02	0.23	0.02	Active	Inactive
7	550	550	0.72	0.02	0.23	0.02	Active	Inactive
8	600	600	0.02	0.02	0.02	0.02	Inactive	Inactive
9	700	700	0.02	0.02	0.02	0.02	Inactive	Inactive
10	800	800	0.02	0.02	0.02	0.02	Inactive	Inactive

TABLE II
MEASUREMENT DATA ON MAGNETIC SENSORS

Sample	Distance	Current	Description
1	0.5 cm	0.14 A	Active
2	1 cm	0.14 A	Active
3	1.5 cm	0.1 A	Inactive
4	2 cm	0.1 A	Inactive
5	2.5 cm	0.1 A	Inactive
6	3.5 cm	0.1 A	Inactive
7	4 cm	0.1 A	Inactive
8	4.5 cm	0.1 A	Inactive
9	5 cm	0.1 A	Inactive
10	5.5 cm	0.1 A	Inactive

TABLE III
TROUBLESHOOTING

No.	Problem	Cause	Action
1	The tool could not be turned on	The pin cable was broken The power supply was faulty	Checking the PLN cable Checking Input Voltages
2	The sensor reed switch could not work	This sensor had long resulted in reduced sensor sensitivity	Replacing the sensor with a new one
3	The PIR sensor could not work	Broken wires Faulty PIR sensor	Checking the input voltage Replacing the PIR sensor
4	The lamp could not turn on	• Faulty lamp driver	• Checking cables • Changing the lamp

Table 1 depicts that the PIR sensor output voltage from experiments 1-7 at a horizontal distance could reach up to 550 cm with a voltage of 0.72V and a current of 0.23A. In contrast, it could only reach a maximum distance of 400 cm at the vertical distance with a voltage of 0.72V.

The characteristic of a magnetic sensor was that the sensor would be detected at a distance of 3 cm. However, as seen in Table 2, the sensor only detected at a distance of 0.5 cm – 1 cm, due to its vertical distance. Then, at a distance of 1.5 cm – 5.5 cm, the magnet sensor was inactive. As for some troubleshooting tools are presented in Table 3.

V. Conclusion

Vertically it could only reach a maximum distance of 400 cm with 0.72 V voltage.

The results of planning, designing, writing, and analyzing the data for detecting schizophrenia patients can be concluded as follows:

1. A schizophrenia patient detection device could detect if patients were running away from the inpatient room.
2. A schizophrenia patient detection device could also be used in the baby's room to prevent kidnapping and provide more intensive care.
3. The PIR sensor could detect at a distance of 50 cm - 550 cm.
4. Magnetic sensors could detect at a distance of 0.5 cm - 1 cm.

References

[1] W. Gamayanti, "Gambaran Penerimaan Diri (Self-Acceptance) pada Orang yang Mengalami Skizofrenia," Psympathic J. Ilm. Psikol., vol. 3, no. 1, pp. 139–152, 2016.

[2] S. Zahnia and D. Wulan Sumekar, "Kajian Epidemiologis Skizofrenia," Majority, vol. 5, no. 5, pp. 160–166, 2016.

[3] Balai Penelitian dan Pengembangan Kesehatan, "InfoDatin-Kesehatan-Jiwa.pdf." p. 12, 2018.

[4] M. B. Santoso, H. Krisnani, and I. Hadrasari, "Intervensi Pekerja Sosial Terhadap Orang Dengan Skizofrenia," Share Soc. Work J., vol. 7, no. 2, p. 1, 2017.

[5] Rosdiana, "Identifikasi Peran Keluarga Penderita dalam Upaya Penanganan Gangguan Jiwa Skizofrenia Identification of the Family Role to Handling Schizophrenia Patients," Mkmi, vol. 14, no. 2, pp. 174–180, 2018.

[6] I. Kaunang, E. Kanine, and V. Kallo, "Hubungan Kepatuhan Minum Obat Dengan Prevalensi Kekambuhan Pada Pasien Skizofrenia Yang Berobat Jalan Di Ruang Poliklinik Jiwa Rumah Sakit Prof Dr. V. L. Ratumbuysang Manado," J. Keperawatan UNSRAT, vol. 3, no. 2, p. 107679, 2015.

[7] อารียา เสรีภาพ สุทรี นาคพร้อม, "No Title การเมือง," vol. 000, pp. 1–13.

[8] A. A. Rifqi, R. P. Handajani, and N. S. As, "Elemen Ruang Dalam pada Fasilitas Rawat Inap Pasien Gangguan Jiwa Berdasarkan Aspek Keamanan," JIK, vol. 3, no. 2, pp. 120–130, 2003.

[9] S. Riyadi and B. E. Purnama, "Sistem Pengendalian Keamanan Rumah Berbasis Sms Menggunakan Microcontroler ATmega8535," Indones. J. Netw. Secur., vol. 2, no. 4, pp. 7–11, 2013.

[10] S. Dewanto, Budi, Maconie, Windy, "Perancangan Sistem Keamanan Ruangan Berbasiskan Mikrokontroller ATMEGA8535," J. Tek. Komput., vol. 21, no. 9, pp. 24–35, 2013.

[11] B. K. Jiwa, F. Keperawatan, U. Syiah, and K. Banda, "Karakteristik Pasien Skizofrenia Dengan Riwayat Rehospitalisasi," Idea Nurs. J., vol. 7, no. 3, pp. 23–29, 2016.

[12] G. K. Dewi, "Pengalaman Caregiver dalam Merawat Klien Skizofrenia di Kota Sungai Penuh," J. Endur., vol. 3, no. 1, p. 200, 2018.

[13] A. Gayung, "Sistem Pengaman Rumah Dengan Security Password Mengunakan Sensor Gerak Berbasis Mikrokontroler At89S51," Tugas Akhir, Dep. Fis. Fak. Mat. dan Ilmu Pengetah. Alam Univ. Sumatera Utara Medan, 2009.

[14] F. W. Satrianto, G. Budiman, B. Setiadi, F. T. Elektro, and U. Telkom, "Sistem Keamanan Berbasis Android Vehicle Tracking Dengan," vol. 3, no. 1, pp. 486–493, 2016.

[15] W. Tri Rahajoeningroem, "Sistem Keamanan Rumah Dengan Monitoring Menggunakan Jaringan Telepon Selular," Telekontran, vol. 1, no. 1, 2013.

[16] M. Chamdun, A. F. Rochim, and E. D. Widianto, "Sistem Keamanan Berlapis pada Ruangan Menggunakan RFID (Radio Frequency Identification) dan Keypad untuk Membuka Pinta Secara Otomatis," J. Teknol. dan Sist. Komput., vol. 2, no. 3, pp. 187–194, 2014.

[17] R. Toyib, I. Bustami, D. Abdullah, and O. Onsardi, "Penggunaan Sensor Passive Infrared Receiver (PIR) Untuk Mendeteksi Gerak Berbasis Short Message Service Gateway," Pseudocode, vol. 6, no. 2, pp. 114–124, 2019.

[18] B. A. B. Ii, "Bab ii pendekatan pemecahan masalah," pp. 7–31, 1852.

[19] "Daftar Isi," Psycho Idea, vol. 14, no. 2, p. 1, 2016.

[20] A. H. Andriawan and F. Teknik, "Penerapan Atmega8 Untuk Mengukur Tegangan Keluaran," vol. 01, no. 01, pp. 81–92, 2016.

[21] Z. Lubis and S. Aryza, "Analisa Perancangan Penggunakan Mikrokontroler ATMega 8 Sebagai Pengendali dan Sensor Gerak untuk Pendeteksi Gerak Berbasis SMS," J. Electr. Technol., vol. 2, no. 3, 2017.

[22] H. V. Christensen, "Retrieval of 3D-position of a passive object using infrared led's and

photodiodes," ICASSP, IEEE Int. Conf. Acoust. Speech Signal Process. - Proc., vol. IV, no. 1, pp. 1093–1096, 2005.

[23] R. C. Jisha, M. V. Ramesh, and G. S. Lekshmi, "Intruder tracking using wireless sensor network," 2010 IEEE Int. Conf. Comput. Intell. Comput. Res. ICCIC 2010, pp. 389–393, 2010.

Authors' information

Erika Loniza received a Bachelor of Engineering degree from the Department of Electrical Engineering Universitas Muhammadiyah Yogyakarta in 2006, a Master's Engineering degree from the Department of Electrical and Information Technology Engineering, Universitas Gajah Mada Yogyakarta, Indonesia in 2016. She is a lecturer in the Department of Electromedical Engineering, Vocational Program, Universitas Muhammadiyah Yogyakarta, Indonesia. Her research interests are electrical engineering, instrumentation, and control.

Anugrah Utami received the title of Associate Expert from the Electromedical Engineering Department of Vocational Program at Universitas Muhammadiyah Yogyakarta, Indonesia. Her research interest is electronic medical.

Meilia Safitri received a Bachelor of Engineering degree from the Department of Electrical Engineering Universitas Diponegoro in 2012, a Master's Engineering degree from the Department of Electrical and Information Technology Engineering, Universitas Gajah Mada Yogyakarta, Indonesia in 2015. She is a lecturer in the Department of Electromedical Engineering, Vocational Program, Universitas Muhammadiyah Yogyakarta, Indonesia. Her research interests are electrical engineering, instrumentation, and control.

Yuli Ermawati received a Bachelor of Engineering degree from the Department of Electrical Engineering from Universitas Muhammadiyah Yogyakarta in 2001, a Master's Engineering degree from the Department of Electrical Engineering from Universitas Mercu Buana Jakarta, Indonesia in 2016. She is a lecturer in the Electronics Engineering Department, Engineering and Computer Science Faculty, Universitas Baturaja, Indonesia. Her research interests are electronic engineering and management telecommunication.