Jurnal Teknologi Informasi dan Pendidikan
Volume 15, No. 2, September 2022
https://doi.org/10.24036/tip.v15i2

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
tip.ppj.unp.ac.id

Augmented Reality-Based Programming Using Atmega 2560 Microcontroller Trainer Kit Support.

Satrinawati[1*]✉, Dedy Irfan[2], Efrizon[3]
[1]Informatic Education Department, Faculty of Enginering, Universitas Negeri Padang, Indonesia
**Corresponding Author: satrina0983@gmail.com*

Article Information

Article history:

No. 670
Rec. December 23, 2022
Rev. January 18, 2023
Acc. March 28, 2023
Pub. March 29, 2023
Page. 110 – 121

Keywords:

- *Trainerkit*
- *Mikrokontroler*
- *Augmented Reality*
- *AtMega 2560*

ABSTRACT

The application of an augmented reality system to the Atmega 2560 microcontroller trainer kit is a tool designed to create learning methods that are interactive, fun, motivating, and provide space for students to develop creativity and independence. This research uses research and development (R&D) methods. This research and development consists of a preliminary study stage, needs analysis, design, manufacture, testing of tool specifications and the final stage is product evaluation with expert opinion. The development of this microcontroller trainer kit has three main parts, namely the microprocessor, input and output. The microcontroller used is the ATmega 2560. By using augmented reality technology and adding electronic components such as DC motors, servo motors, ultrasonic sensors, this tool can be used in sensor and transducer learning. Apart from learning sensors, this trainer kit can also be applied to learning microcontrollers and their applications. This trainer kit is equipped with a practicum module as a support in learning. Through the microcontroller trainer kit and Augmented reality system, it is hoped that student competency will be better.

1. INTRODUCTION

Developments in the field of knowledge and technology (Science and Technology) have an impact on all aspects of life [1]. In addition to rapid development, change also occurs quickly. Because of this, humans must adapt to manage and utilize education and technology (Science and Technology) proportionally and maximally [2]. Technological progress is something that cannot be avoided in this life, technological progress will develop according to the progress of human knowledge[3]. Humans as users of technology should be smarter in utilizing technology in the era of globalization[4]. The process of adaptation to technology is one way to adjust to education. This is done in giving birth to a new generation that understands the progress of renewable technology [1]. One of the factors

that can support the quality of student learning outcomes is the availability of learning media.[2].

The learning method is an operational step of the chosen learning strategy to achieve learning objectives (Sani, 2019). A good learning process must contain interactive, fun, motivating aspects, and provide space for students to develop creativity and independence. Interesting learning media is needed to increase students' understanding of a material besides that problems sometimes arise when access to physical objects is needed to provide an explanation to students of a material, for example material related to microcontrollers. One of the developments media in learning is the media learning using Augmented Reality.

Augmented Reality is an application who combine the real world with the virtual world in two dimension or three dimension form projected into an environment real at the same time. Ilmawan Mustaqim in Raajan (2014) mentions that Augmented Reality was first used in 1957 – 1962 by a cinematographer named Norton Heilig, who was named 'Sensorama'. Sensorama is a simulator that can simulate visuals, vibration and smell. This technology can make people get the thrill of exploring and learning, fun and unique because they directly involved in the learning. AR great opportunity in the world of education because students can directly interact with objects contained in this application.

Based on the problems above, the authors found a way to achieve the above goals by making innovations, namely learning methods and applying Augmented reality technology that is closer to the microcontroller trainer kit. on this occasion the author will design and create a tool called "Implementation of Augmented Reality on the AT Mega 2560 Microcontroller Trainer Kit" as a form of solving the problems described above.

Indexing and abstracting services depend on the accuracy of the title, extracting from it keywords useful in cross-referencing and computer searching. An improperly titled paper may never reach the audience for which it was intended, so be specific.

2. RESEARCH METHOD

The type of research used is Research and Development orwith 4-D model development procedure. Research and development used to produce certain products, and test the effectiveness of these products. The 4-D development model was chosen because it has a systematic procedure and in accordance with the background of this research problem. The 4-D model proposed by Thiagaraja (in Sugiyono, 2015:28) "4-D model uses main stages : Define, Design, Development and Dissemination."

2.1 Tool and System Design

The design of the product design consists of several stages starting from searching and gathering information related to the system, designing the system, making tools to

testing, and generating reports. The flow of important research before carrying out system design, which is used to simplify the stages of making tools, will be explained in the form of a block diagram.

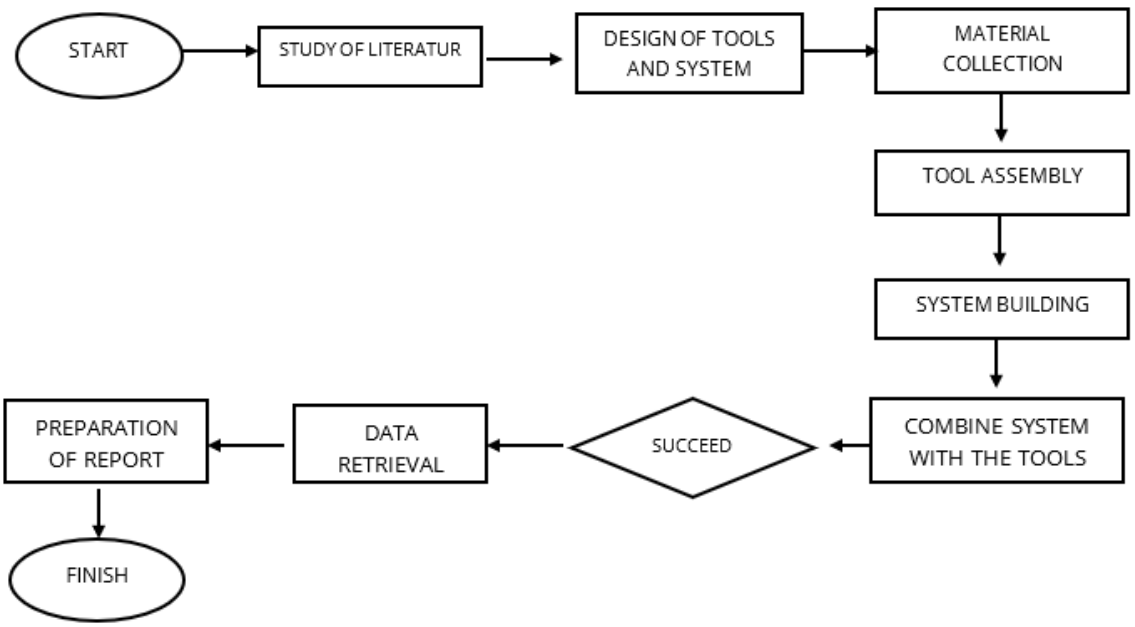

Figure 1. (Tool Design Flow Chart)

Starting with a literature study, namely a series of activities related to collecting library data, reading and recording related research, then proceed with designing tools and systems with the aim of preparing what is needed in making tools and systems followed by collecting materials, what materials are needed. used in making tools and systems after the goods are collected, proceed with assembling the tools, in this step the author has started to make a microcontroller trainer kit, after the tools are ready, proceed with making an augmented reality system, and after the microcontroller and augmented reality trainer kits are ready, start by integrating the two if successful proceed to the stage of data collection and preparation of reports.

2.2 Design of ATmega 2560 Microcontroller Kit Trainer System

Researchers use the research and development model as a method to produce a microcontroller trainer kit. The design of this study aims to develop a programming training board in the form of a Microcontroller Trainer Kit to support microcontroller programming

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
tip.ppj.unp.ac.id

learning/practicum activities. The stages of this research and development in this study are described in the flowchart as follows:

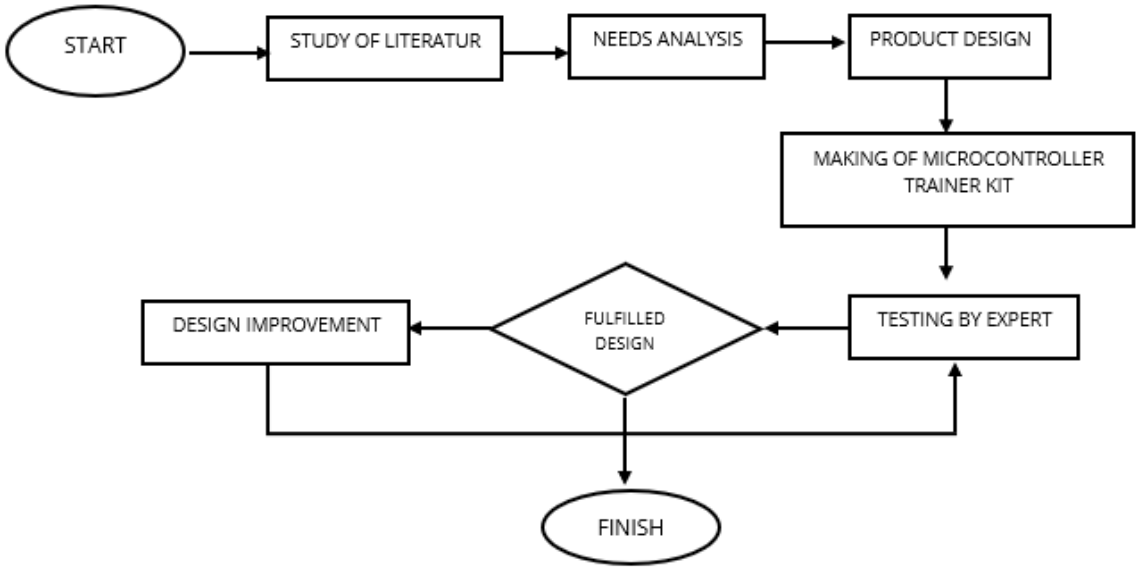

Figure 2. Planning diagram for making a trainer kit

Literature study is a series of activities related to library data collection methods, reading and recording and processing research materials that aim to develop tools to be made. Needs analysis is a series of activities to determine the needs or conditions that must be met in a new product or product development that takes into account the needs of users. The product design of the Microcontroller trainer kit is realized in a product design drawing, schematic and a series of product layouts that are in accordance with the needs analysis of the user or learning system, followed by testing by experts if the trainer kit passes the test then the trainer kit will be ready to use.

2.4 Previous Research

This research refers to previous literature reviews where a lot of related research has been carried out "Augmented Reality and Trainerkit mikrokontroler AT mega 2560" in the form of the following design and analysis. As a reference, the authors took three journal from several years ago as an improvement for this research.

1. Based on Grace's research in, 2011 **Augmented reality (AR)** aims to take the real world as a basis by combining several virtual technologies and adding contextual data so that the understanding of humans as users becomes clearer [3]
2. In research by mustaqim scientists in 2016 entitled **Utilization of Augmented Reality as a Learning Media**, it gives the idea that "Some AR applications are

designed to provide users with more detailed information than real objects. Media is a tool or object that functions as a liaison between the recipient and sender of messages. Learning media is an intermediary tool between educators and students in learning that is able to connect, provide information and channel messages so as to create an effective and efficient learning process."[4].

3. Based on Mustofa Abu Hamid's research in 2020 in his research entitled Development of a Microcontroller Trainer Kit The trend of the industrial revolution 4.0 has made microcontrollers increasingly in demand to be developed and even every educational institution has begun to study in depth in the field of microcontrollers to be included in education,

This research with the title Application of Augmented Reality on Microcontroller Trainer Kits has several advantages over previous studies. In this study, the microcontroller used was the Arduino AT mega2560 where the advantage of this Arduino is that it has many pins and this research adds an augmented reality system to optimize the learning process.

3. RESULTS AND DISCUSSION

From the discussion above, it is found that this tool focuses on learning programming using the Atmega 250 trainer kit. In order to make learning more interactive, interesting and efficient, augmented is one of the media that is suitable for use. The following is a discussion regarding the working system of the Atmega 2560 Trainerkit tool with Augmented Reality support :

3.1. Trainerkit Mikrokontroler Function

Trainerkit can assist students in understanding each concept explained through visual media (images/videos) as well as written/text. With the existence of a trainer kit, all material or concepts that are still imaginary (imagination) can be realized in real terms so that they can be carried out in real practice. The trainer kit also helps improve students' skills and creativity, because by using a trainer, it is easier for students to explore and try several practicums with various variables**.**

3.2. Product Description

In the process of designing the microcontroller trainer kit hardware using several components including Arduino ATmega 2560, Regulator 5V and 3.3V, Micro Servo 3.7G, DC Motor, Power Switch 8 Pin, Seven Segment 4 Digit, LED Matrix 8x8, Sensor LUX BH1750, Buzzer, Graphic LCD, Ultrasonic Sensor, Encoder, Gyro MPU5060, LIDAR VL53LOX, LED, Temperature, NTC, Push Button, LDR, Trimpot, BreadBoard, MP3, and PSU. To make learning easier, this trainer kit is equipped with augmented reality, videos,

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
tip.ppj.unp.ac.id

and learning modules. This product has an external goal for Vocational High School students to be able to better understand learning about microcontrollers

No	Module	Pin Name	Level	Function	Needed Pin	Used Pin
1	5 Push button	SW1	5V	Input	Digital/Interupt	D2/INT 4
		SW2	5V	Input	Digital	D4
		SW3	5V	Input	Digital	D5
		SW4	5V	Input	Digital	D6
		SW5	5V	Input	Digital	D7
2	8 LED	L1	5V	Output	Digital/Pwm	D8
		L2	5V	Output	Digital/Pwm	D9
		L3	5V	Output	Digital	D22
		L4	5V	Output	Digital	D23
		L5	5V	Output	Digital	D24
		L6	5V	Output	Digital	D25
		L7	5V	Output	Digital	D26
		L8	5V	Output	Digital	D27
3	Trimpot	T1	5V	Input	Analog	A0
4	LDR	S1	5V	Input	Analog	A1
5	NTC	S2	5V	Input	Analog	A2
6	Sensor suhu DS18B20	S3	5V	Input	Digital	D3
7	MPU6050	SDA	3.3 - 5V	Data	I2C Pin/ Digital	D20
		SCL	3.3 - 5V	Data	I2C Pin/ Digital	D21
8	LIDAR VL53L0X	SDA	3.3 - 5V	Data	I2C Pin/ Digital	D20
		SCL	3.3 - 5V	Data	I2C Pin/ Digital	D21
9	BUZZ	B1	5V	Output	Digital/Pwm	D13
10	Encoder	OUTA	5V	Input	Digital/Interupt	D18
		OUTB	5V	Input	Digital/Interupt	D19
11	LUX BH1750	SDA	3.3 - 5V	Data	I2C Pin/ Digital	D20
		SCL	3.3 - 5V	Data	I2C Pin/ Digital	D21
		ADDR	3.3 - 5V	Output	Digital	D29
12	LCD 1.3"	SCK	3.3V	Data	SPI Pin/Digital	D52
		MOSI	3.3V	Data	SPI Pin/Digital	D51
		DC	3.3V	Output	Digital	D30
		RST	3.3V	Output	Digital	D31

Jurnal Teknologi Informasi dan Pendidikan
Volume 15, No. 2, September 2022
https://doi.org/10.24036/tip.v15i2

13	Ultraso ni k	BLK TRIGGE R	3.3V	Output	Digital	`D12
			5V	Output	Digital	D32
		ECHO	5V	Input	Digital	D33
14	8x8 Mat rix	SCK	5V	Data	SPI Pin/Digital	D34
		DIN	5V	Data	SPI Pin/Digital	D35
		CS	5V	Output	Digital	D36
		Data Pin	5V	Output	Digital	D38
15	Seven Segme nt	Clock Pin	5V	Output	Digital	D37
		Latch Pin	5V	Output	Digital	D39
		Dig1	5V	Output	Digital	D40
		Dig2	5V	Output	Digital	D41
		Dig3	5V	Output	Digital	D42
		Dig4	5V	Output	Digital	D43
16	Mot or DC	InA	5V	Output	Digital/Pwm	D10
		InB	5V	Output	Digital/Pwm	D11
17	Motor Servo	Signal	5V	Output	Digital/Pwm	D44
18	MP3	signal	5V	output	Digital	D45
19	PSU	Supply	12-5v-3.3 v	Input / output	Arus 3.3 A	

Table 1. Pin Description

3.3. Topology Design

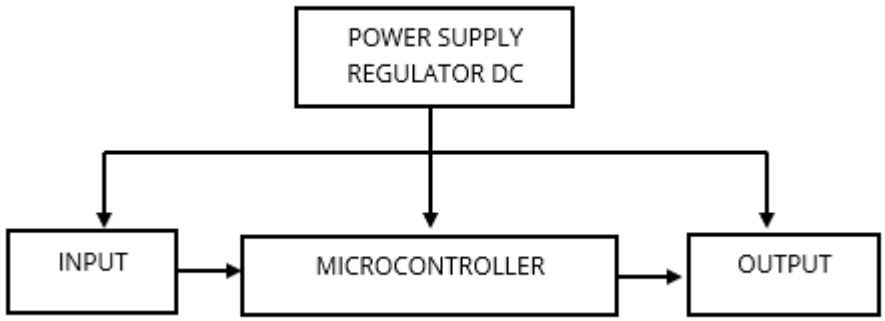

Figure 3. Flowchart system Trainerkit Microcontroller

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
tip.ppj.unp.ac.id

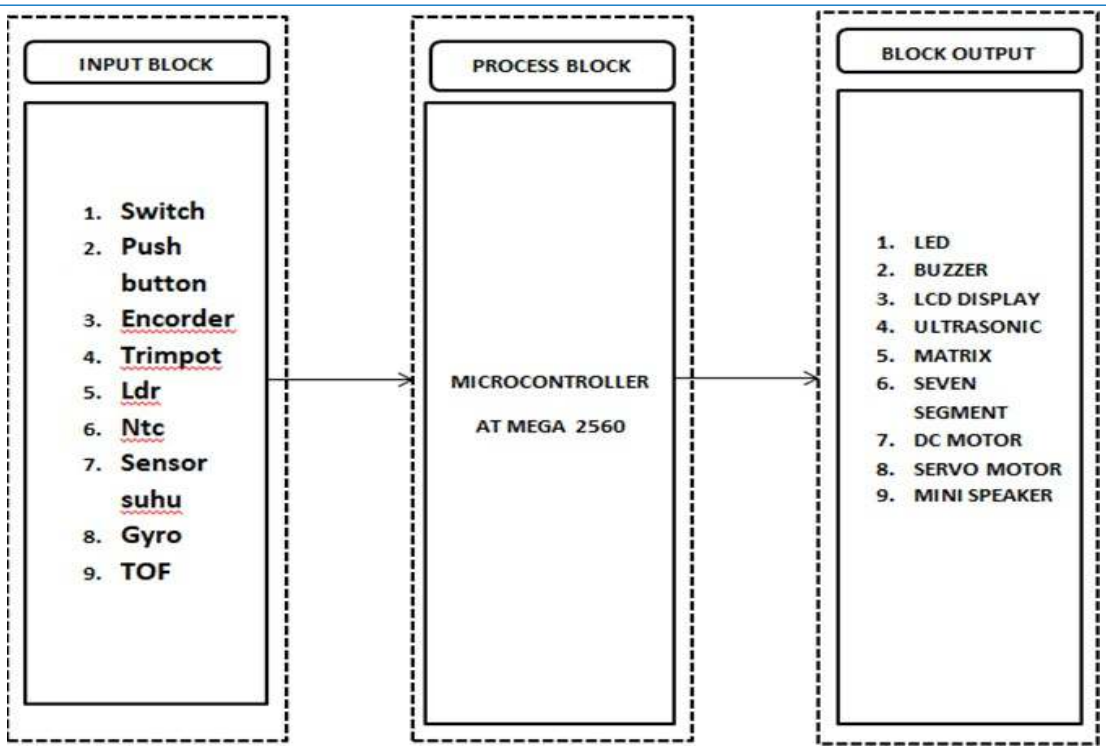

Figure 4. Blok Diagram System Trainerkit

3.4. Hard And Soft Design

This chapter provides an overview of the mechanical, electrical and program appearance of the Arduino software to make it easier for the reader to understand the system printed on the tool.

3.4.1. Electrical Design

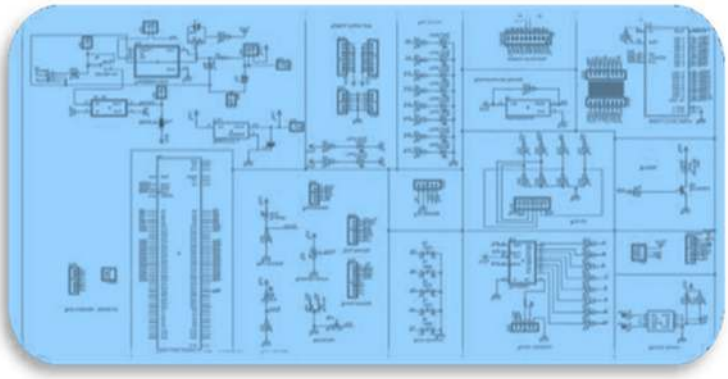

Figure 5. Schematic Electrical

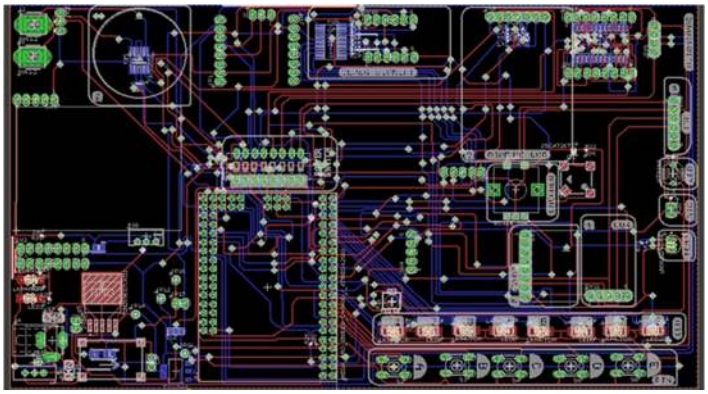

Figure 6. layout Electrical

This microcontroller trainer kit uses the Ardduino IDE software. Arduino IDE stands for Integrated Development Environment which is software for writing programs, compiling and uploading programs to the Arduino board. The hardware design of the microcontroller trainer is broadly divided into 5 module parts which are combined into one in a microcontroller trainer, that part is Power. supply regulator, ATmega 2560 microcontroller. Supply voltage trainerkit is a power supply regulator. All components are connected to Arduino Atmega 2560 as a microcontroller trainer kit controller

3.4.2. Mekanikal Design

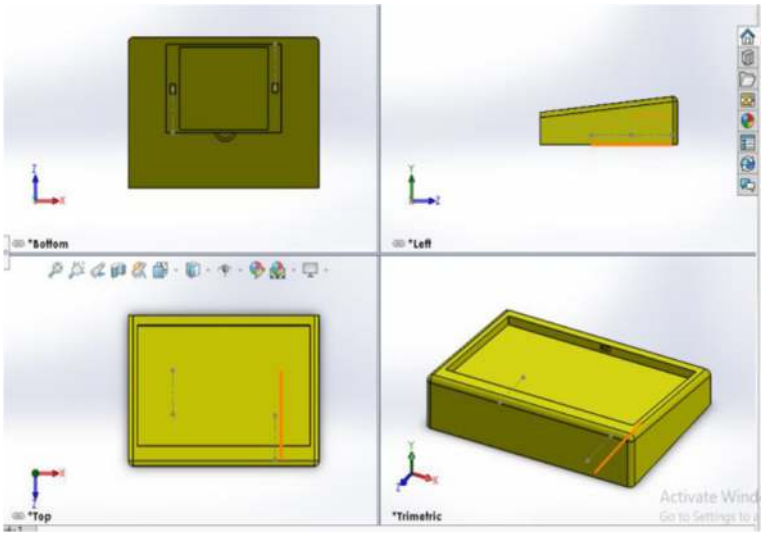

Figure 7. Design Box of Trainerkit

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
tip.ppj.unp.ac.id

3.4.3. Program Code

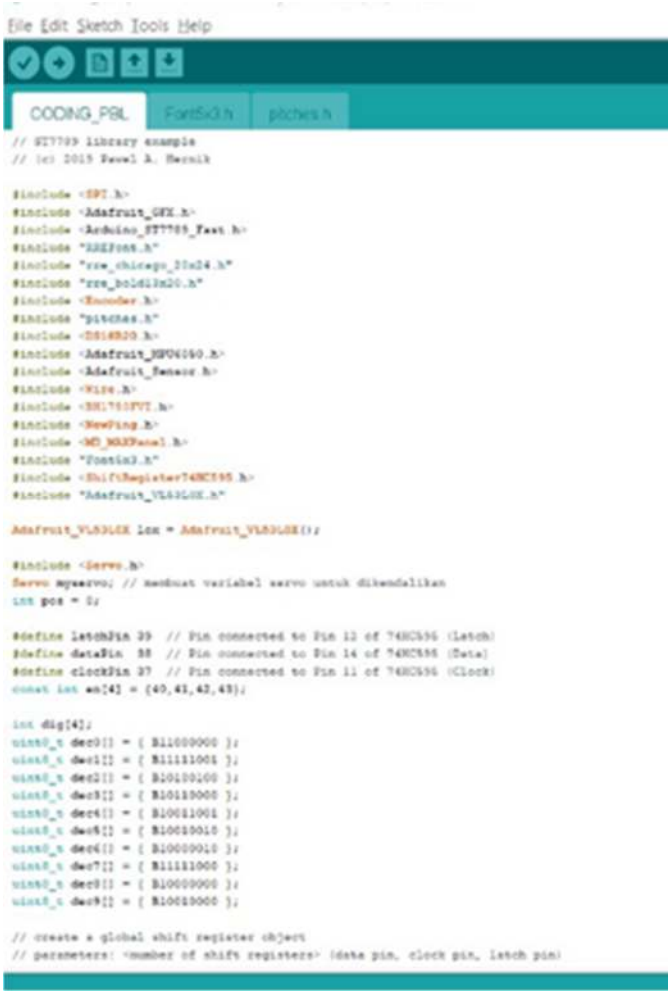

Figure 8. Program Code

3.4.4 Design Augmented Reality

The working concept of implementing Augmented Reality on the Atmega 2560 microcontroller trainer kit will be displayed in the image below :

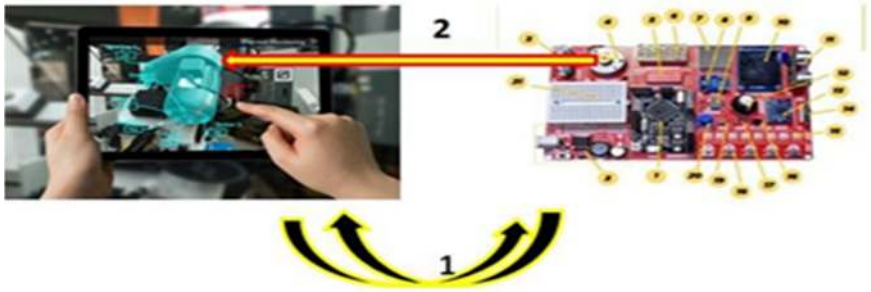

Figure 9. tools system

1. Arrow number 1 shows an alternating arrow which means the microcontroller trainer kit must be connected to the augmented reality system, and vice versa the augmented reality system must be connected to the microcontroller.
2. Arrow number 2 shows the components on the microcontroller tool data sheet will be displayed

4. CONCLUSION

This research has succeeded in developing a trainer kit for the Atmega 2560 and Arduino IDE microcontrollers. This microcontroller trainer kit is made flexible because it can be used in sensor and microcontroller applications. Hardware design diagrammatically can assist researchers in making supporting components for modules that will be needed in the schematic design and layout of the microcontroller trainer. The diagram that describes the hardware system in general is then poured into the schematic design and layout per module. There is also an advanced assisted learning system in this case for designing a box or pcb cover. Advanced assisted learning using the solidwworks app. There are various ways of learning using the tools available in the Solidworks application

REFERENCES

[1] Akbar, A. (2017). Pengontrol Suhu Air Menggunakan Sensor Ds18B20 Berbasis Arduino Uno. *Pengontrol Suhu Air Menggunakan Sensor Ds18B20 Berbasis Arduin*[5][6][7][8]

[2] ADDIN Mendeley Bibliography CSL_BIBLIOGRAPHY Adnan Feriska, D. T. (2017). RANCANG BANGUN PENJEMUR DAN PENGERING PAKAIAN OTOMATIS BERBASIS MIKROKONTROLER. *Jurnal Coding Sistem Komputer Untan*, *05*(2).

[3] Evalina, N., & A Azis, H. (2020). Implementation and design gas leakage detection system using ATMega8

P.ISSN: 2086 – 4981
E.ISSN: 2620 – 6390
tip.ppj.unp.ac.id

microcontroller. *IOP Conference Series: Materials Science and Engineering*, *821*(1). https://doi.org/10.1088/1757-899X/821/1/012049

[4] Marek, G., & Peter, Š. (2014). Home Security System Using Reconfigurable Robot. *American Journal of Mechanical Engineering*, *2*(7). https://doi.org/10.12691/ajme-2-7-28

[5] Pratiwi, I. T. M., & Meilani, R. I. (2018). Peran media pembelajaran dalam meningkatkan prestasi belajar siswa (The role of learning media in increasing students ' learning achievement). *Jurnal Pendidikan Manajemen Perkantoran*, *3*(2).

[6] Putu, I. G., Suastina, B., Nuada, I. W., Faezal, M., & Fitri, S. M. (2021). *Pengaruh Motivasi , Pelatihan , Disiplin Dan Pengembangan Karir Terhadap*. *07*(02), 105–112.

[7] J. Koivisto and J. Hamari, "The rise of motivational information systems: A review of gamification research," *International Journal of Information Management*, vol. 45. 2019. doi: 10.1016/j.ijinfomgt.2018.10.013.

[8] B. Berendt, A. Littlejohn, and M. Blakemore, "AI in education: learner choice and fundamental rights," *Learn Media Technol*, 2020, doi: 10.1080/17439884.2020.1786399.

[9] F. Lyu, "Architecture as spatial storytelling: Mediating human knowledge of the world, humans and architecture," *Frontiers of Architectural Research*, vol. 8, no. 3, 2019, doi: 10.1016/j.foar.2019.05.002.

[10] M. Ibrahim, P. M. Ribbers, and B. Bettonvil, "Human-knowledge resources and interorganisational systems," *Information Systems Journal*, vol. 22, no. 2, 2012, doi: 10.1111/j.1365-2575.2011.00377.x.

[11] G. Marek and Š. Peter, "Home Security System Using Reconfigurable Robot," *American Journal of Mechanical Engineering*, vol. 2, no. 7, 2014, doi: 10.12691/ajme-2-7-28.

[12] N. Evalina and H. A Azis, "Implementation and design gas leakage detection system using ATMega8 microcontroller," in *IOP Conference Series: Materials Science and Engineering*, 2020. doi: 10.1088/1757-899X/821/1/012049.

[13] S. Ulum and M. Budiyanto, "Prototipe Pengaman Pintu Rumah Menggunakan Voice Recognition dengan EasyVR Berbasis Mikrokontroler," *Jurnal Listrik, Instrumentasi dan Elektronika Terapan (JuLIET)*, vol. 1, no. 2, 2021, doi: 10.22146/juliet.v1i2.60744.

[14] A. Wijaya, B. Eichinger, J. Rose, B. Sartory, M. Mischitz, and R. Brunner, "3D Microanalysis of Porous Copper Using FIB-Tomography in Combination with X-ray Computed Tomography," *Microscopy and Microanalysis*, vol. 23, no. S1, 2017, doi: 10.1017/s1431927617001957.