Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT

ISSN 2723-4509 (Online)

DESIGN OF ARDUINO UNO-BASED EARTHQUAKE LEVEL VIBRATION LEVEL DETECTION

Hidayatullah[1*], Jhonson Efendi Hutagalung [1]
[1]Computer Technic, Sekolah Tinggi Manajemen Informatika Dan Komputer Royal, Indonesia

Corresponding author:
dayatscorpio2@gmail.com

Keywords:
arduino uno
bluetooth
microcontrollers
robots
smartphones

ABSTRACT

This study aims to develop from the basis of an earthquake detection system that is controlled by a vibration sensor based on Arduino Uno which can later be developed into the future for the advancement of sophisticated robot technology so that it is useful for the benefit of science. Using these sensors can find out that an earthquake will occur so that an SMS will be sent to the officer to notify the public that there has been a danger caused by a continuous earthquake that can take its toll. This tool, although still in miniature form so that it can have the advantage of senesitivity to ground vibration can be detected quickly. This system has been successfully created and tested so that it can be a forerunner for the safety of the earthquake disaster that will occur when it is rife.

INTRODUCTION

Very rapid technological developments in the current era of globalization have provided many benefits in the progress in various aspects. The use of technology by humans in helping get work done is a necessity in life. And also the development of technology can also improve the equipment used in providing safety and comfort to the disasters that will occur caused by nature. Especially the frequent occurrence of earthquakes that shake the earth with gradual vibrations to vibrations that are big. Earthquakes are vibrations in the earth that occur as a result of the release of energy that collects suddenly in deformed rocks.

Indonesia is included in a country that is often hit by earthquakes. Various attempts can be made to minimize the impact of earthquakes, such as disseminating information on earthquake saving, building earthquake resistant buildings and designing earthquake alarms. Earthquake alarms should be in homes and offices, so that they can provide warnings when an earthquake occurs and instruct the steps to be taken. An alarm can be made to detect an earthquake using a sensor as a vibration detector. This sensor is mounted above ground level. Testing is done by vibrating the ground near the sensor used.

Earthquakes are vibrations in the earth that occur as a result of the release of energy that collects suddenly in deformed rocks. Indonesia is included in a country that is often hit by earthquakes. Various attempts can be made to minimize the impact of

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

earthquakes, such as disseminating information on earthquake saving, building earthquake resistant buildings and designing earthquake alarms. Earthquake alarms should be in homes and offices, so that they can provide warnings in the event of an earthquake and instruct the steps to be taken[1].

Based on the background above, it takes an effort to detect earthquake vibrations produced so that residents or the surrounding community know the level of vibrations caused by the earthquake, and with this detection can be quickly identified by the surrounding community to be able to avoid if an earthquake occurs.

The effectiveness of several sensors, including the vibrating sensor commonly used in vibration detectors. Judging from the problems that occur, then we need an early vibration detection system easily and cheaply, efficiently, and accurately. The existence of ground shaking, can be detected so that it can provide information as early as possible if there are signs of an impending earthquake. If there will be an earthquake where low, medium or strong ground vibrations can be seen on each LED indicator and alarm sound. the sensor will provide a signal input to the microcontroller so that the officer can provide information to the surrounding population to be able to avoid the danger of the earthquake disaster by sounding the alarm[1]. How is the performance of the sensor to detect ground vibration levels when an earthquake will occur. How is the performance of the tool system made in informing the existence of earthquakes based on ground vibrations. How to create programs that can be used by Arduino microcontrollers with the Arduino IDE application. The sensor used is a vibrating sensor. The control center uses an Arduino Uno microcontroller. The system is made in a miniature form, the detection factor is carried out only in the presence of vibration. Output uses buzzer and led alarm sound levels. To determine the performance of the sensor to detect the level of ground vibration when an earthquake will occur. To understand the performance of the system the tool is made in informing the existence of an earthquake based on ground vibrations. To be able to create programs that can be used by Arduino microcontrollers with the Arduino IDE application. Can facilitate officers in monitoring the occurrence of earthquakes. With data from land movements that have been detected, it makes it easier for monitors to identify the potential for earthquakes, so as to minimize material losses and casualties due to earthquakes. Can inform the level of earthquake conditions that will occur.

Arduino is an open source physical computing platform based on a simple input / output (I / O) sequence and development environment that implements Processing language. Arduino can be used to develop interactive objects independently or can be linked to software on your computer (such as Flash, Processing, VVVV, or Max / MSP). The circuit can be assembled by hand or purchased. Arduino IDE (Integrated Development Environment) is open source[2]. Arduino was created for beginners even who do not have a basic programming language at all because it uses the C ++ language which has been facilitated through the library. Arduino uses Processing Software that is used to write programs into Arduino. Processing itself is a combination of C ++ and Java languages. This Arduino software can be installed on various operating systems (OS) such as: LINUX, Mac OS, Windows. Arduino is not just a development tool, but a combination of hardware, programming languages and a sophisticated Integrated

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

Development Environment (IDE). IDE is a piece of software that is very instrumental in writing programs, compiling it into binary code and uploading it into a microcontroller memory[3]. Is a transducer that serves to refuse variations from a value in the form of light, motion or heat into voltage and electric current. Transducer itself has a meaning that is to change. The form of change in question is the ability to convert an energy into another form of energy. The energy processed aims to support the performance of devices that use the sensor itself. The sensor itself is used in the detection process for the measurement process. In this final project the sensor used is the 801S vibrating sensor. Vibration sensor Vibration sensor is a device that has a function to detect vibrations and will be converted into electrical signals. The 801S vibration sensor has a very high sensitivity to vibrations. Vibration sensor 801S has 2 types of output namely, analog output and digital output. The sensitivity of the digital output can be adjusted with the potentiometer on the sensor. This sensor can read an analog output value in the form of ADC to get the value of a vibration condition that occurs around. To find out be [4]. Buzzer is an electronic component that functions to convert electrical vibrations into sound vibrations. Basically the working principle of the buzzer is almost the same as the loud speaker, so the buzzer also consists of a coil mounted on the diaphragm and then the coil is flowed so that it becomes an electromagnet, the coil will be attracted in or out, depending on the direction of the current and the magnetic polarity, because the coil is mounted in the diaphragm, each movement of the coil will move the diaphragm back and forth so as to make the air vibrate which will produce sound. This buzzer is used as an indicator (alarm)[5].

METHOD

For a system design block diagram is used as a step to make it easier to start making the system, where the block diagram illustrates in general how the system works with the devices used. In this planning it is explained that the sensor will provide incoming data to function as an input circuit and the data is then processed by Arduino and the results of the control process enable the relay to open and close the led circuit. DC vibration sensor circuit consists only of resistor components as voltage dividers at DC voltage, which is directly connected to the microcontroller input, which consists of DC input and output parts. Pictures of each series can be seen in the image below:

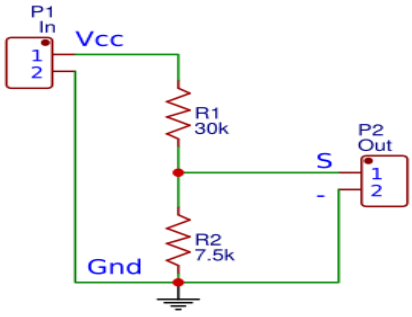

Image 1. DC Vibration Sensor Circuit

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

To control this vibration change using an Arduino Microcontroller IC which is an Atmega 328 IC connected to other components to form a minimum system in a circuit kit on a PCB board. Figure IC microcontroller circuit with other components can be seen in Figure 3.3.

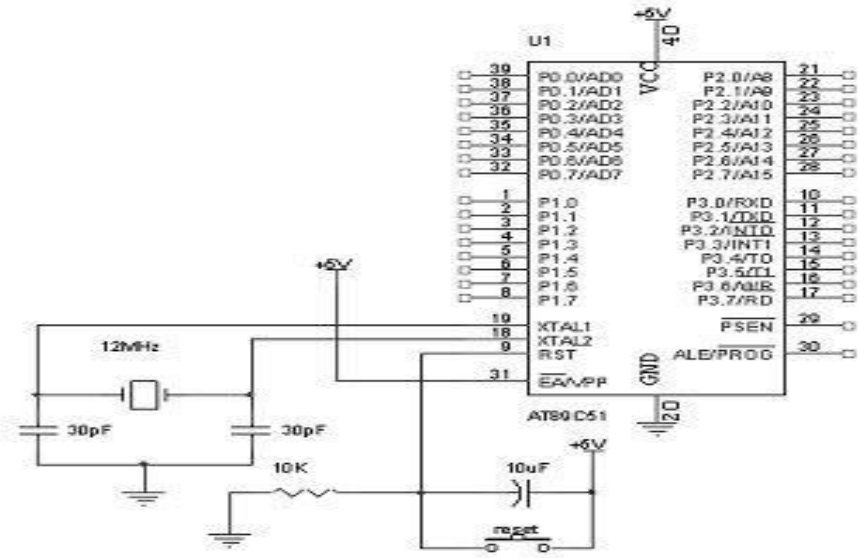

Image 2. Arduino Uno Minimum System Series

The load circuit only consists of a buzzer that is directly connected to the led lights. The output of the microcontroller will activate the buzzer so that NO contacts will close to supply a 12 volt voltage to the led lights. In order to load both the Relay or the component used to work, a Buzzer is needed to activate it. This buzzer series serves as a notification that an earthquake has occurred.

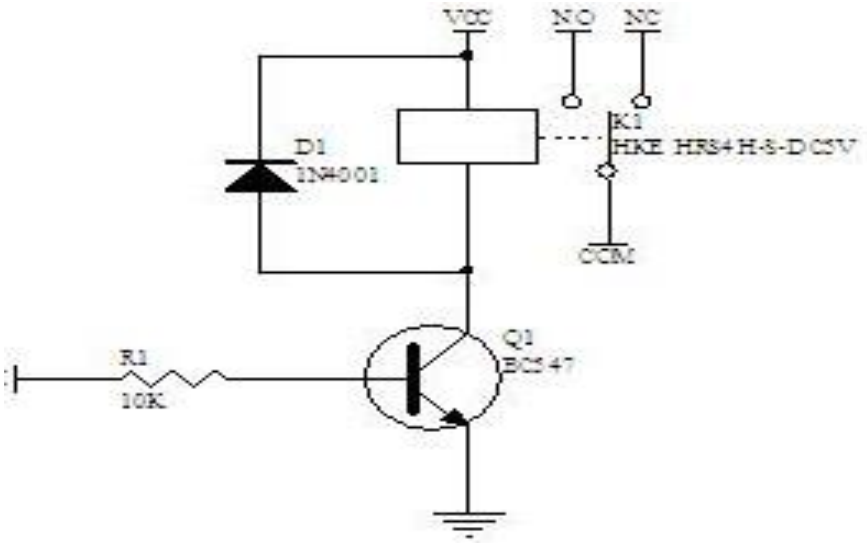

Image 3. Buzzer Circuit Connected To LEDs

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

For the whole circuit of the vibration level detection system automatically consists of a combination of vibration sensor circuit, Arduino Microcontroller circuit, power supply or battery circuit, buzzer circuit and led lights. The overall series can be seen in the image below.

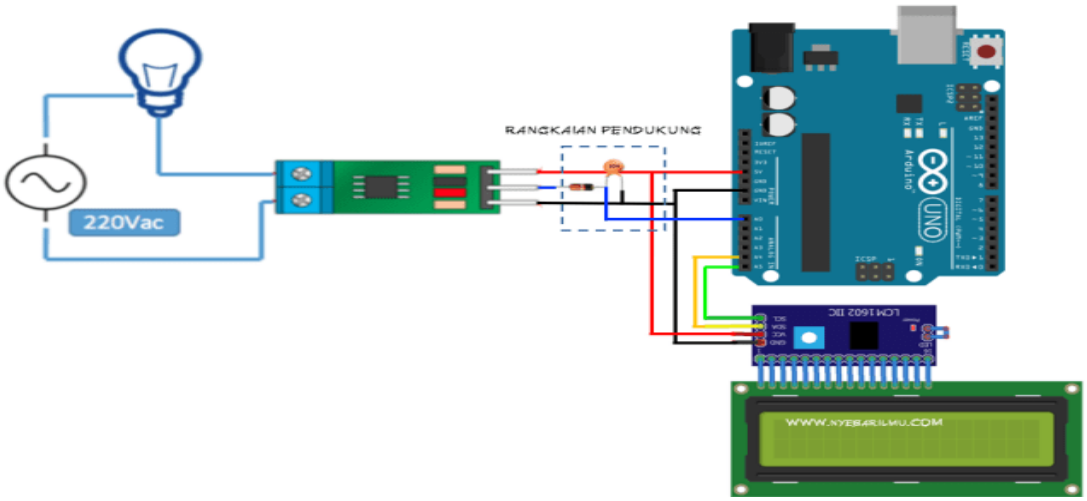

Image 4. Overall Ciruit

RESULT AND DISCUSSION

Detection system to find out the vibration or not the same thing as knowing that an earthquake has occurred so that we can take action that needs to be done if an earthquake directly occurs. This tool serves to keep know that vibrations have occurred on the surface of the earth. In implementing the system, system testing is needed. This system is controlled by using a vibration sensor as a vibration detector, a microcontroller circuit, as a control center, a buzzer connected to the circuit, led lights and software or programs. To control that the tool designed works as expected then that hardware and software testing is also carried out.The power supply used is a full wave power supply. Power supply testing is done by providing alternating input voltage (AC) 220 Volts directly from the PLN. For the output voltage of the travo that has been connected to the power supply circuit, measurements are taken for the 12-CT-12 tap on the power supply voltage output.

Table 1. Testing of Power Supply

No	Voltage Input (AC)	Load Resistor (Ohm)	Voltage Output (DC)	Information
1	220 V	5	4.5	Under Voltage
2	220 V	10	4.8	Under Voltage
3	220 V	20	5	Standard

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

To make the power supply test circuit can be seen in the image below.

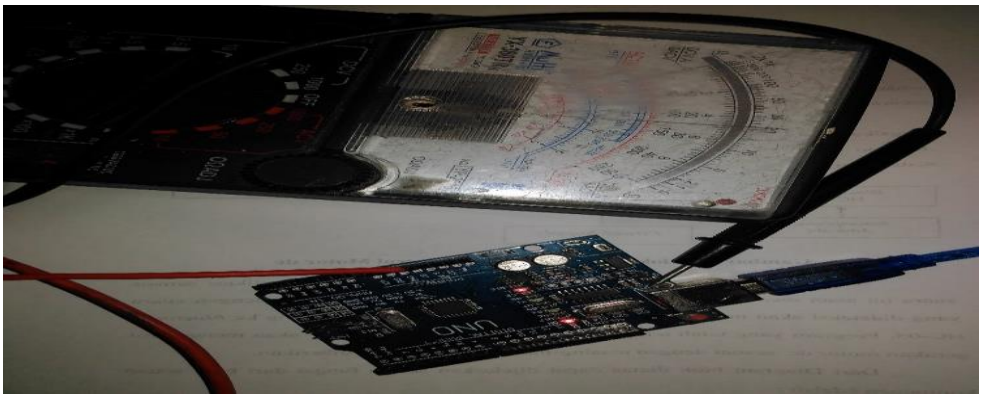

Image 5. Testing of Power Supply

Microcontroller testing is done by programming the microcontroller using the C programming language, and testing the microcontroller used whether it still works as it should or when it is not working. Below is a picture of the results of microcontroller testing.

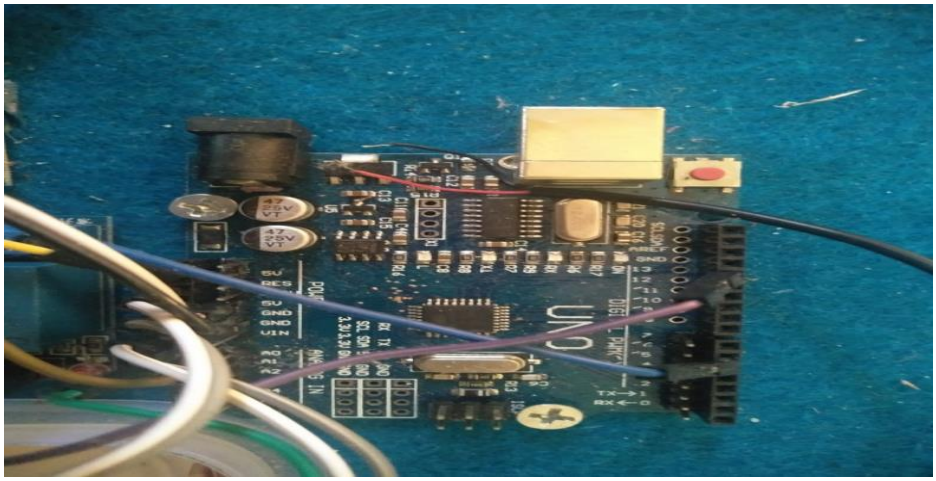

Image 6. Microcontroller Testing

The voltage from the power supply (input) supplied to the microcontroller varies not to pass the voltage from the microcontroller then voltage measurements are taken at one of the output / input ports on the VCC and Ground pins. The following table is the result of the measurement of the microcontroller experiment.

Table 2. Minimum System Testing (Arduino Uno)

No	Voltage Input (AC)	Voltage Output	Information
1	12 V	5	Standard Voltage
2	9	4.5	Under Voltage
3	6	4	Under Voltage
4	4.5	3.5	Under Voltage

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

For testing the vibration sensor circuit, a multimeter is needed to measure the voltage output of the sensor test results manually. On the vibrating sensor by giving a blow produces a vibrating object on the sensor so that the voltage value changes on the multimeter. Testing this sensor circuit is done by measuring the output voltage to ground.

At each sensor is given a voltage source VCC and Ground and the pin (output) is connected to the multimeter the positive probe (red wire) and the black wire (negative probe) is connected to the ground, then see the change in the value of the numbers indicated by the pointer on multimeter.

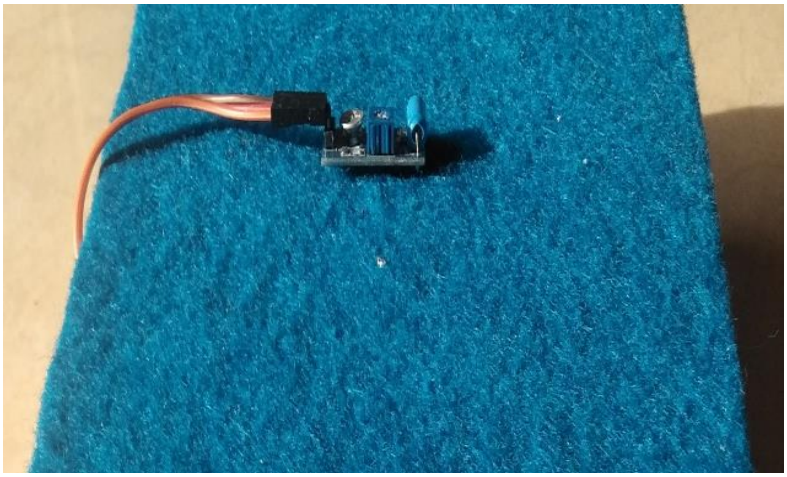

Image 7. Sensor Testing

Then read the measurement results enter the data into the table.

Table 3. Sensor Testing Results

No	Vibaration	Voltage Output	Information
1	Yes	4	Active Buzzer and Led
2	No	0	No Active Buzzer and Led

The success of this temperature detection can also be determined by the placement of the vibration sensor. Where is the best we put the sensor close to the conditions to be detected. In testing the buzzer is carried out by giving vibration to the sensor so that there will be a vibration detected by the sensor so that the buzzer will sound at once the LED will light up and if there is no vibration the green LED will light while the buzzer does not sound. The series can be seen in Figure 4.5 below:

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

Image 8. Testing of Buzzer and Led Circuits

The buzzer test results can be seen in table 4.4. If there is no vibration can be seen in the test results table.

Table 4. Relay Testing

No	Vibaration	Voltage Output	Current (A)	Information
1	Yes	5	0.045	Buzzer and Red Led Active
2	No	0	0	Buzzer and Green Led Active

This program is carried out by means of the microcontroller to initialize the process first according to the type of microcontroller used in this program by using the Arduino Uno microcontroller. After the initialization process is successful, the next process is initializing the connection between the microcontroller and the other system circuits.

In the design of the detection of vibrations that have occurred, the vibration detected by the sensor with a change in the value of the voltage caused by vibrating the surface where the sensor is placed as a whole consists of a series of joints ranging from sensor circuits, microcontroller circuits, buzzer circuits and led lights that are connected overall so that it becomes a control tool that can know the existence of vibrations on the ground surface. This microcontroller will provide current to the buzzer and led.

Based on the results of testing and analysis of the test data table that if there is detected a vibration, the buffer and the LED lights up while if it does not vibrate only the green LED lights up. The image below is a miniature automatic vibration detection based on Arduino.

Proceeding
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT
ISSN 2723-4509 (Online)

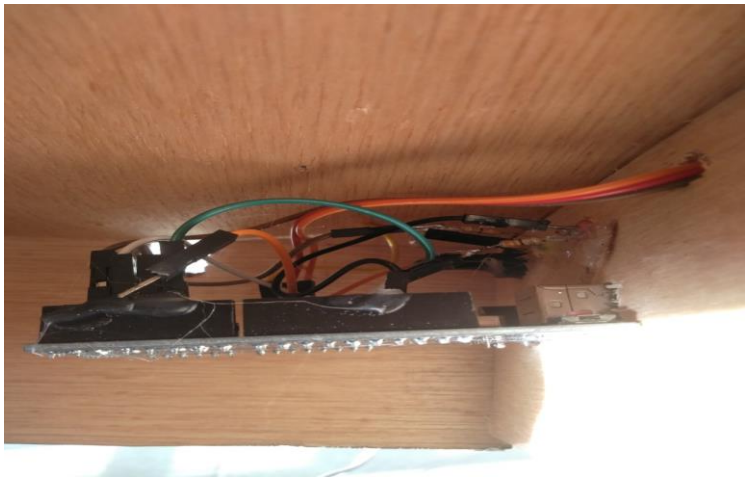

Image 9. Overall Series Display

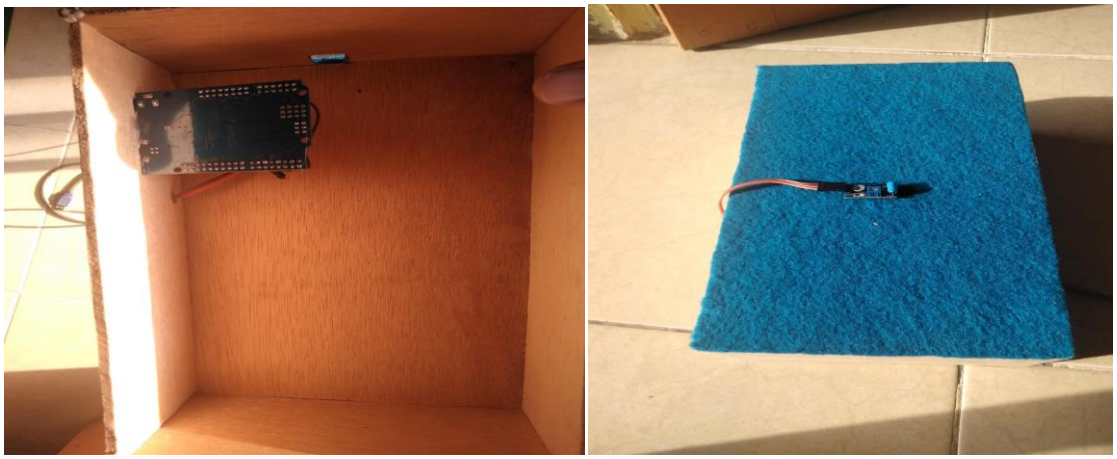

Image 10. Display Tools From Above And Display of the Bottom of the Tool

CONCLUSION

From the discussions in the previous chapters, conclusions can be drawn, namely: Every vibration can be detected by taking the value of the voltage generated by the sensor so that the microcontroller gives commands to the LED and the buffer buffer working. The vibration is known by the vibrating sensor that has been placed above ground level so that with a single vibration there will be a notification indicator in the form of a buzzer and led. Data obtained from the detection of the vibration sensor are controlled using the Arduino Uno microcontroller which has been programmed using the Arduino IDE C Programming Language as a tool to detect earthquakes.

Proceeding **ISSN 2723-4509 (Online)**
International Conference
on Social, Sciences and Information Technology
Kisaran, August 19th, 2020, hlm. 43 - 52
DOI: https://doi.org/10.33330/icossit.v1i1.755
Available online at https://jurnal.stmikroyal.ac.id/index.php/ICdoSSIT

BIBLIOGRAPHY

[1] M. Rahman, M.N., Yusfi, "RANCANG BANGUN SISTEM ALARM GEMPA BUMI BERBASIS MIKROKONTROLER AVR ATmega 16 MENGGUNAKAN SENSOR PIEZOELEKTRIK Muhammad Nurul Rahman , Meqorry Yusfi," *J. Fis.*, vol. 4, no. mikrokontroler, pp. 350–357, 2015.

[2] S. J. Sokop, D. J. Mamahit, M. Eng, and S. R. U. A. Sompie, "Trainer Periferal Antarmuka Berbasis Mikrokontroler Arduino Uno," *E-Journal Tek. Elektro Dan Komput.*, vol. 5, no. 3, pp. 13–23, 2016, doi: 10.35793/jtek.5.3.2016.11999.

[3] J. Arifin, L. N. Zulita, and Hermawansyah, "Perancangan Murottal Otomatis Menggunakan Mikrokontroller Arduino Mega 2560," *J. Media Infotama*, vol. 12, no. 1, pp. 89–98, 2016, [Online]. Available: https://jurnal.unived.ac.id/index.php/jmi/article/view/276/257.

[4] C. K. Ardhi, M. A. Murti, and R. Nugraha, "Perancangan Alat Pendeteksi Gempa Menggunakan Sensor Accelerometer Dan Sensor Getar (Design of Earthquake Sensor System Using Accelerometer and Vibrace Sensor)," *J. Teknol. Dan Pendidik.*, vol. 5, no. 3, pp. 4019–4027, 2018.

[5] W. dan R. W. Purnamasari, "Sistem Keamanan Rumah Menggunakan Sensor Getaran Dengan Output Suara Berbasis Pc," *J. Manaj. dan Inform. Pelita Nusant.*, vol. 21, no. 1, p. 59, 2017.