Internet of Things (IoT) – Based for Noise Detection and Alert Notification in the Library

Renny Maulidda[1*], Abdurrahman Abdurrahman[2], Agum Try Wardhana[3], Muhammad Amri Yahya[4]

[1-4]Department of Electrical Engineering, Politeknik Negeri Sriwijaya, Palembang, Indonesia
rennymaulidda@polsri.ac.id

Abstract. Libraries are facilities available in education that can support the creation of quality education. In order to focus and concentrate when reading books or doing activities in the library, visitors certainly need an atmosphere that is quiet, comfortable, and less noisy. Based on State Minister of Environment KEP-48/MENLH/11/1996, the standard of library noise level ranged from 45 to 55 dB. The design of an Internet of Things-based for noise detection and alert notification in the library is made to control the noise level by humans or other things. The process of this device is that the sound sensor will detect sounds with a certain noise level. The signal read by the sensor is an analog voltage which will then be sent to the microcontroller NodeMCU6288 and converted from analog voltage to decibels. Then, the LCD displays alert notification, so that the noise level in the library room can be controlled. This device works if it reads the sound with a limit of >55 DB then the LCD screen will display the condition and the speaker will play the alert notification.

Keywords: Noise Detection, Internet of Things, Alert Notification

1 Introduction

The library is a place to get information and a place of learning for students and the community. Unfortunately, noise in the library is still common, especially from the visitors themselves. Library staff have made efforts to overcome this, by warning visitors who make noise, but library staff certainly do not always warn or control the situation because of limited staff, and others.

Visitors who come to the library certainly need a comfortable and quiet atmosphere so that they can focus and concentrate when reading books or doing activities in the library [1]. Based on the Decree of the Minister of Environment KEP-48/MENLH/11/1996 on noise levels, that the noise standard in the library environment ranges from 45-55 dB [2,3]. A decibel (hereinafter: dB) is a unit for measuring sound intensity with a sound threshold limit that can be heard by human [4]. But there are visitors who only come to chat, thus disturbing the concentration of other visitors who are reading. If it is left unattended, this will lead to a decrease in the interest of visitors to come to the library.

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Some researcher has investigated about noise detection based IoT. Prototype devise for noise detection based on NodeMCU8266 and V2 sound sensor with the C programming language has been made. The sound level monitored by LED and send it to telegram [5]. Other research is about a simple experimental activity to measure the sound level using Android smartphone [6]. The noise detector can detect the voice of person and when the person speaks loudly, an alert message can send automatically to the person by the IoT. But it is only in small area. This study also has done by [7].

In this research, the design of a noise detection and warning control system device in a library room based on the Internet of Things (IoT) is carried out. The components used are KY-037 sound sensor modules which work to convert sound quantities into electrical quantities in the form of analog voltage. This tool also uses the NodeMCU ESP8266 microcontroller device which has a wifi connection facility. The MIT App inventor application is one of the IoT platforms that aims to control the NodeMCU ESP8266 via the internet. With MIT App inventor, users can do computer programming to create software applications with Android-based operating systems. This device will be able to detect the noise of library visitors based on sound pressure parameters or sounds that will appear on LCD and speakers with research objects in the library, so that noise in the library can be controlled.

2 Research Method

In the process of carrying out this research, there is a structure or system of implementation stages in order to achieve maximum work results, namely general preparation, tool testing, and tool application and evaluation if needed.

Fig. 1. Step of research

1 General Preparation
The type of preparation carried out to support the final project research is the preparation of problem identification, framework, literature review program, and other preparations.

2 Device-Making
The device-making stage is carried out in several stages, namely providing the necessary electrical or mechanical components, making electronic circuit schematics, mechanical device design, and making programs.

3 Device Testing
Testing is carried out to determine the performance of the overall system and whether the device made is in accordance with what was previously planned.

4 Implementation
At this stage, the entire device has been successfully completed and is ready for implementation by conducting a simulation first.

5 Evaluation
The purpose of the evaluation is to find out whether the objectives and programs have been achieved so that further improvements and developments can be made to achieve the desired results. Evaluation can be done through development discussions and report writing.

2.1 System Design

A block diagram is a diagram of a system, where the main parts or functions represented by the blocks are connected by lines, which show the relationship of the system.

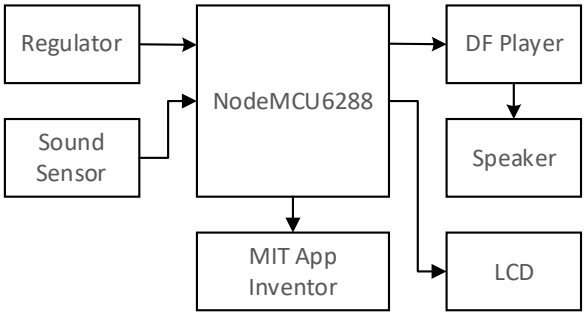

Fig. 2. The diagram block of the system

The system block is divided into an input block, a data processing block, an output block, and a monitoring system block. The input comes from the sounds by humans or things. The sound is read by the sound sensor, then the sound will be read as a voltage and amplified by an amplifier circuit, then sent to the microcontroller which then outputs the results in the form of a DF Player and a reprimand sound through the speakers, and the MIT App inventor application is one of the IoT platforms that aims to monitoring the level sound condition via smartphone.

2.2 Flowchart

Flowchart is a form of system work flow that is a standard of planning and describing of the system process.

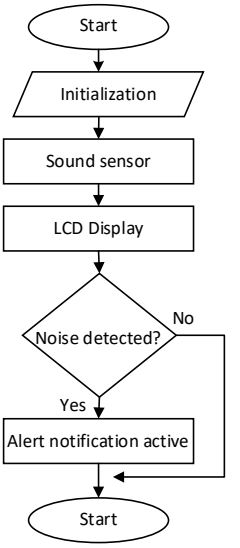

Fig. 3. The flowchart of the system

From the process above, it is known that when the KY-037 sound sensor detects noise, the results obtained are two possibilities and the LCD will display a description and dB number from the detection results. The first normal condition is between 40-55 dB which is displayed on the LCD in the form of a reading "Tidak berisik", and the second is abnormal which is more than 55 dB with a reading on the LCD that is "Harap semuanya diam", and an alert notification will sound.

2.3 Flowchart

The website designed in this system is used to design the results of the system's work and can be accessed remotely with the help of an internet connection making it easier to find out the results of the system's work. On the initial page when opening the website, an account login will be displayed to access the website.

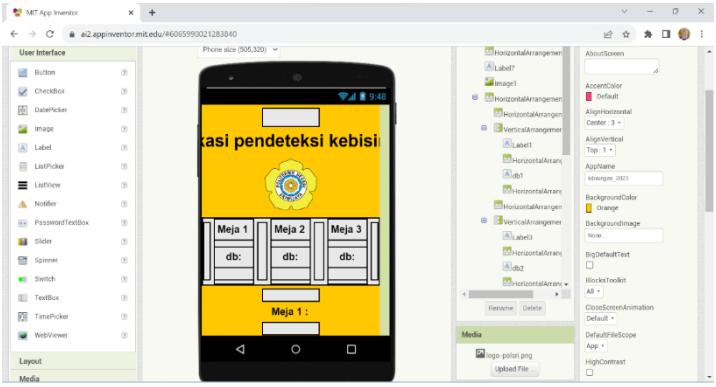

Fig. 4. Website Design of MIT App Inventor

2.4 Wiring Design

Control system on this device is carried out to fulfill the overall design system starting, with detecting the sound on the KY-037 sound sensor, the output results from the NodeMCU 8266 module, and the results that will be displayed on the LCD. In the process of testing sound detection, researchers are in a library that is quite crowded.

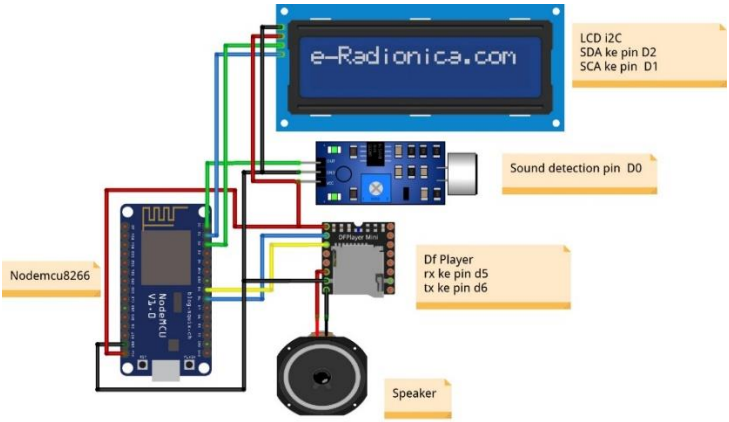

Fig. 5. Circuit Schematic

3 Result Analysis

Testing is performed to check the suitability or alignment between system components. The purpose of this system test is to ensure that the system components have functioned as desired.

In this LCD test, the NodeMCU8266 is given a program to display the noise level detected by the sound sensor so that the noise level will be known. The test results show that the LCD can display the noise level that has been detected by the sound sensor. On the first line of the LCD display, it will show the noise level in dB units, and on the second line the LCD will display a notification of the noise level.

Fig. 6. LCD Indicator

3.1 Sound Sensor Testing

Testing the sound sensor is done by testing the distance to the sound sensor whether the response given by the sound or high-volume sound will work based on what it should be or not.

Table 1. Result of Sound Sensor Testing

Testing	Distance (cm)	Sound Detection (dB)	Alert on LCD
1.	45	70	ON
2.	50	68	ON
3.	60	67	ON
4.	70	66	ON
5.	80	65	ON
6.	110	63	ON
7.	120	60	ON
8.	130	59	ON
9.	135	57	ON
10.	140	56	ON
11.	145	55	ON
12.	150	52	OFF

From the table above, known that the alert notification will ON if the noise detects more than 55dB and the sound sensor can detect the noise with a long distance about 145cm.

3.2 Result of Sound Level Meter with Noise Detector

A Sound level meter in the form of a digital device is used to determine how many decibel values when there is sound. The sound level meter is used as a decibel comparison with the noise detector that has been made.

Table 2. Result of Sound Level Meter with Noise Detector

Sound Level Meter (dB)	Sound Sensor KY-037 (dB)	Error (%)
46	45	1
48	47	1
52	50	2
55	53	2
61	55	4
63	58	5
64	63	1
63	65	2
66	67	1

70	72	2
Average		2.1

From the table above, known that the error average is about 2.1% between the sound level meter and the device of noise detector that has been made. It means that the error average percentage is small means that the value is still acceptable

4 Conclusions

This tool works if the sound reading is >55 DB then the LCD screen will display a warning and the speaker will issue a warning sound from the NodeMCU8266 module not to make noise in the room. The noise monitoring tool has been designed, and tested and its success rate is known. The monitoring results show that the tool functions properly by sending data results and displaying them through the LCD, but there are weaknesses in the level of sensitivity of the sensor that is less detailed due to the small sensor sensitivity range, so further research and sensor updates with a high sensitivity range are needed.

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