Design of Library Noise Detection Tools Based On Voice Pressure Parameters Using Nodemcu Esp8266

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ABSTRACT

A library visitor would want a quiet atmosphere without noise when in the library so that he can concentrate when reading a book. However, not all visitors who come to the library to read books, there are visitors who just want to chat, use free wifi or other, so that it disturbs the concentration of other visitors who come to read books. Therefore, it is necessary to have a tool to detect sound pressure or sound based on the sound level and the sound produced in a library based on the noise level limit in the library, namely 45-55 dB (desible). This tool is designed based on a microcontroller where the definition of a microcontroller is a complete microprocessor system contained in a microcontroller chip which is different from the multi-purpose microprocessor used in a PC, because a microcontroller generally already contains the minimum system supporting components of a microprocessor, namely memory and programming. This tool can help officers in monitoring the library room from noise that can interfere with the concentration and comfort of library visitors. Based on the results of testing the overall system is as desired, namely the noise detection tool can work in an integrated system, where when the sound sensor detects a noise that exceeds the sound limit, the buzzer will sound, the red led light turns on, the sound module issues a voice message pre-recorded and also the device can be controlled or monitored from the web application.

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1. INTRODUCTION

Noise is unwanted sound or sound that comes from human activities that can cause health problems and comfort in the environment. Underwater noise pollution at riverbanks threatens dolphins and fish along the middle and lower reaches of the Yangtze River, China studied by Wang [1]. Understanding the relationship between air traffic noise exposure and disturbance in populations living near airports in France was studied by Lefèvre [2]. Airport noise and wildlife conservation: What are we missing? researched by Alquezar [3]. Exposure to noise and air pollution by modes of transport during peak hours in Montreal was investigated by Apparicio [4]. The efficiency of noise mitigation measures at European airports was investigated by Alonso [5].

The spatial-temporal changes of road traffic noise pollution at an ecoregional scale were studied by Iglesias-Merchan [6]. The incidence of depression in relation to transport noise exposure and noise

disturbance in the SAPALDIA study was investigated by Eze [7]. The data set for measuring noise levels in the metropolitan city of Ota, Nigeria was studied by Oyedepo [8]. Noise pollution alters the permeability matrix for anuran dispersion: Differential effects among land covers were investigated by Nakano [9]. The relationship between psychomotor efficiency and selected personality traits of persons exposed to noise and vibration stimuli was investigated by Korchut [10].

An echosounder view of the potential effects of impulsive noise pollution on pelagic fish around wind farms in the North Sea was investigated by Kok [11]. The independent association of source-specific transport noise exposure, noise disturbance and noise sensitivity with health-related quality of life was investigated by Cerletti [12]. Underwater noise reduction: Economic factors and policy options investigated by Merchant [13]. Long-term exposure to transport noise and its association with markers of adiposity and obesity development were investigated by Foraster [14]. Aeroacoustics -Noise Prediction Using "LES" for Signal Processing was investigated by Hodor [15].

A Comparative Study of Methods for Assessing Noise Exposure in the Workplace of Fish Harvesters was investigated by Burella [16]. Air pollution, noise exposure, and metabolic syndrome – A cohort study of older Mexican-Americans in the Sacramento area was studied by Yu [17]. Noise pollution was investigated by Slabbekoorn [18]. Traffic noise, noise disturbance and use of psychotropic drugs were investigated by Okokon [19]. The problem of Prediction and Noise Reduction of High Speed Trains was investigated by Ivanov [20].

Aircraft noise, such as heat stress, causes cognitive impairment through a similar mechanism in male rats studied by Sun [21]. Exposure to transportation noise and anxiety: A systematic review and meta-analysis investigated by Lan [22]. Mechanisms of Noise-induced Tinnitus: Insights from Cellular Studies investigated by Shore [23]. Transport noise exposure, noise disturbance, and respiratory health in adults: A repeat measurement study was investigated by Eze [24]. Environmental Noise Performance of Asphalt Rubber Mixture: A case study of Lamia investigated by Mavridou [25]. Noise based on its effect on humans can be divided into three types, namely: disturbing noise, obscuring noise, and destructive noise. Noise limit on library 45-55 dB (decibels).

With the problems described above, Contribution of this paper to build sound pressure detector in library using Node MCU ESP2866. Where this tool uses a sound sensor whose function is to change the amount of sound into electrical quantities. This tool will work if the sound is detected then this tool will produce a warning output not to be noisy in the library in the form of a text display on the LCD and a warning sound through the sound module to alert visitors that the noise level in the library is starting to exceed the limit. This tool will also be equipped with an application that monitors and controls the tools in the library. Such as, turning off the tool, turning on, testing the sound, sound level information and so on.

2. METHODS

In this study, the authors used the Waterfall method, because the waterfall method carried out the work of a system sequentially or linearly. This method is also a method that is often used by system researchers in general. The waterfall model is a waterfall method that provides a sequential or sequential approach to the software life flow starting from analysis, design, coding, testing, and support.

2.1. Needs Analysis

The needs analysis stage is the stage that is carried out to obtain information on what needs are used to build a system. These needs include hardware and software. In this research, the selected hardware is NodeMCU ESP8266 because it is quite easy to operate, and has a wifi device that can connect devices and networks and uses the Arduino IDE as software in coding programs [26]–[28].

2.2. System Design

Is the stage of translating the needs analysis that has been carried out in the previous stage into designing software and hardware that can be estimated first as a guide when building a system. At this stage the writer will design a sketch image as a reference for building a library noise detection tool and its supporting applications.

2.3. Writing Program Code

At this stage the researcher's needs will be translated into a programming language using the Arduino IDE software which will be used with the C ++ programming language, after which the coding is entered into the NodeMCU ESP8266 [29]–[31]. Meanwhile, web-based supporting applications will use the PHP programming language.

2.4. Program Testing

After the coding stage is carried out, the next stage is the stage of testing the program whether there are errors or not in the devices that have been built. By using the C ++ programming language that is integrated with NodeMCU ESP8266 .

2.5. Program Implementation and Maintenance

This stage can be said to be final in making a system. After analyzing, designing and coding the finished tools will be applied to the library. Therefore, implementation and maintenance must be carried out to maintain stability so that unwanted things do not occur.

3. RESULTS AND DISCUSSION

3.1. Hardware Design

Hardware design is a design or series of tools used to make Noise Detection tools.

3.1.1. Sound Sensor minimum system circuit

Sound Sensor is a sensor that has a working method to convert sound into electrical quantities. This series of sound sensors can be seen in Figure 1. The figure shows that basically the working principle of this tool is almost similar to how touch sensors work on devices such as cellphones, laptops and notebooks.

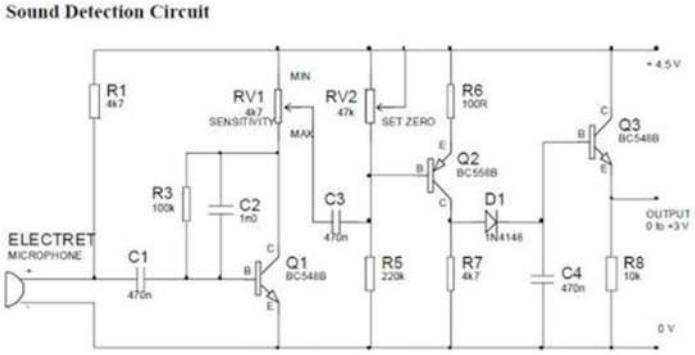


Fig. 1. Sound sensor circuit schematic

3.1.2. NodeMCU Minimum System Circuit

The NodeMCU circuit shown in Figure 2 is an open source IoT platform and development kit that uses the Lua programming language to assist in prototyping IoT products or can use a sketch with the Adruino IDE [34]–[36]. The figure shows that nodeMCU can also be used as a substitute for the Arduino function because it is equipped with a function as a Microcontroller [37]–[40].

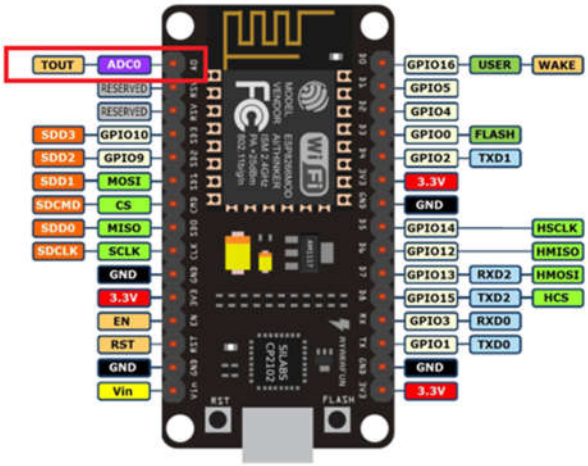


Fig. 2. NodeMCU Circuit Schematic

3.1.3. ISD 1820 minimum system series

The ISD1820 module can be seen in Figure 3 is a Voice Recording / Playback Module that can record and play back audio recordings with integrated storage media (non-volatile memory) integrated in this single ISD1820 chip. The picture shows that with this tool, the sound samples that can be recorded are between 8 to 20 seconds (can be one long sample / several short samples). The maximum recording time is determined based on the sound quality which can be selected between 3.2 kHz (max 20 seconds) to 8 kHz (max 8 seconds).

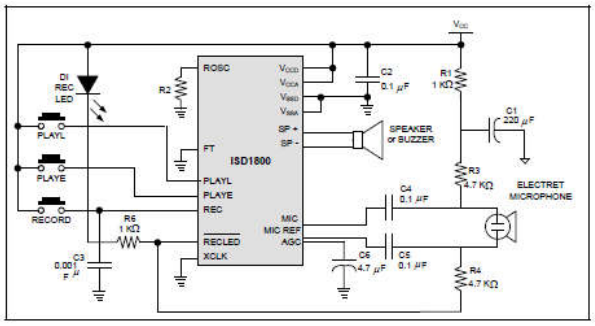


Fig. 3. ISD 1820 Minimum System Series

Implementation is the stage of direct application of the noise detection tool in the library as shown in Figure 4. The figure shows that this stage is also part of the development. Implementation also determines the level of success of the project that has been built. Implementation of Library Visitor Noise Detection Tool Based on Sound Pressure Parameters Using NodeMCU. The image above is a front and side view of the tool. In Figure (1) there are 3 indicator lights on the upper side of the tool and there is a sound sensor section on the bottom side of the tool. In figure (2), there is a part on the right side of the tool with a hole for the adapter connecting the tool to the electric current. In figure (3), there is a blue indicator light that flashes every 2 seconds, there is an LCD that displays the IP of the device and other menus that can be accessed, there are 2 red buttons in the middle on the right that function as to access existing menus on the LCD and the red button on the left as a test sound, then at the bottom there is a sound module that will issue a warning sound if there is excessive noise.



Fig. 4. Display of Noise Detection Tool

Image caption Implementation of the Library Noise Detection Tool Plug the power cord of the library noise detector into the electric current shown in Figure 5. The picture shows that the system waits for the device to connect to wifi. Once the library noise detector is connected to wifi and turned on, the sound sensor will detect excessive noise in the library room. If the sound sensor detects excessive noise in the library room, the NodeMCU as a microcontroller will send a signal to the sound module, buzzer, and red led. Then on the web application, officers can control the operation of the noise detector. Such as viewing sound level information, testing sound, turning on and off noise detectors. The sound level information will be updated automatically once every 3 seconds.

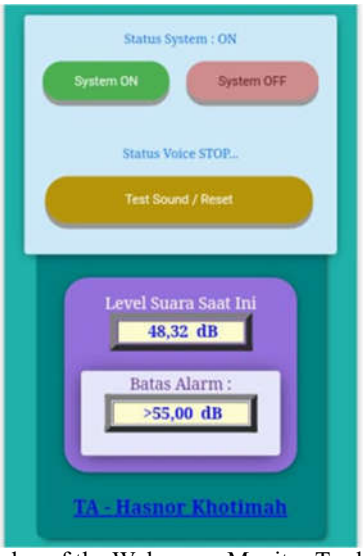


Fig. 5. Display of the Webserver Monitor Tool Application

3.1.4. System Testing

Testing the implementation of the library visitor noise detection tool using NodeMCU is as follows connect the electric current to the power supply or adapter to control the electric power in the equipment circuit. After that, the library noise detection tool will turn on with other supporting devices such as NodeMCU, sound sensor, sound module, buzzer etc. Access the webserver application via IP which can be seen on the menu displayed on the LCD.

3.1.5. Testing Systems with Sound Sensors

This test is done by sounding the sound from the mobile mobile device and my voice at a certain distance from the sound sensor to detect noise. There are 3 LED indicators to indicate how much sound levels are in the library room, Green LEDs (quiet), Yellow LEDs (a bit noisy), Red LEDs (very noisy).

Table 1. Testing System with Microphone sound sensor KY-037

Distance (Meters)	Detection	Response (Led)	Response Time (Seconds)
1	Yes	Red	1.38
2	Yes	Red	2.22
3	Yes	Red	3.69
4	Yes	Red	5.25
5	Yes	Yellow	10.27
6	No	Green	20.11
7	No	Green	30.50

In the test contained in the table above, it is shown that the sound sensor will work up to a maximum distance of 6 meters with the slowest response time of 10.27 seconds, a yellow indicator light that states if the sound is a bit noisy.

4. CONCLUSION

Some conclusions that can be drawn based on the results of the analysis, design and implementation that have been carried out, and based on the formulation of the existing problems are as follows: This tool can help officers in monitoring the library room from noise that can disturb the concentration and comfort of library visitors. This tool is more effective if used in a library room with a smaller room scale, for example a campus library or a library with a room scale that is not too large. Based on the results of testing the overall system is as desired, namely the noise detection tool can work in an integrated system, where when the sound sensor detects a noise that exceeds the sound limit, the buzzer will sound, the red led light turns on, the sound module issues a voice message pre-recorded and also the device can be controlled or monitored from the web application. The sound sensor test results that have been shown in table 1 will work optimally if the noise

comes from a human voice with a maximum distance of 6 meters. Meanwhile, if the sound comes from a mobile device such as a cellphone, the sensor may only work 50% with a maximum distance of 3 meters.

DECLARATION

Author Contribution

In this study, the authors used the Waterfall method, because the waterfall method carried out the work of a system sequentially or linearly.

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Conflict of Interest

Declare conflicts of interest or state "The authors declare no conflict of interest."

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