NOISE POLLUTION MONITORING USING IoT

TEAM MEMBER

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Project: Noise Pollution Monitoring

OBJECTIVE:

Define objectives such as real-time noise pollution monitoring, public awareness, noise regulation compliance, and improved quality of life.

Phase 1: Project Definition and Design Thinking

1.Project Definition

Abstract.

Presently, noise pollution has become a very big issue around the world. The adverse effects of this pollution include hearing impairment, negative social behaviour, annoyance, sleep disturbance and intelligibility to understand people's speech.

In learning context, noise can affect understanding and behaviour of people and places with high noise level are not suitable for learning and teaching process. Internet of Things (IoT) technology is one of the best choices to monitor the noise or sound intensity in the environment for the safety of human being.

The aim of this paper is to deliver a development of an IoT based noise monitoring system comprises of a sound sensor, an IoT platform called NodeMCU, LCD and LEDs. The system will provide a real-time alert if the noise exceeds the threshold noise limit set by Environmental Department of Health standard.

Equipped with an Android application, the data from the sound sensor will be transferred into the cloud server and subsequently transferred into the app for display and to enable remote monitoring.

The sound level is measured for two different days during weekend and weekday. Based on Charted Institution of Building Service Engineers (CIBSE), 60dBA is the permissible ambient level and any readings that above 60dBA can interrupt speech intelligibility. From the research, the suitable time for students to study for weekend is all day starting from morning until midnight. As for weekday, the most suitable time to study is during midnight. These justifications are made based on the readings of the sound level.

2.IoT Sensor Design

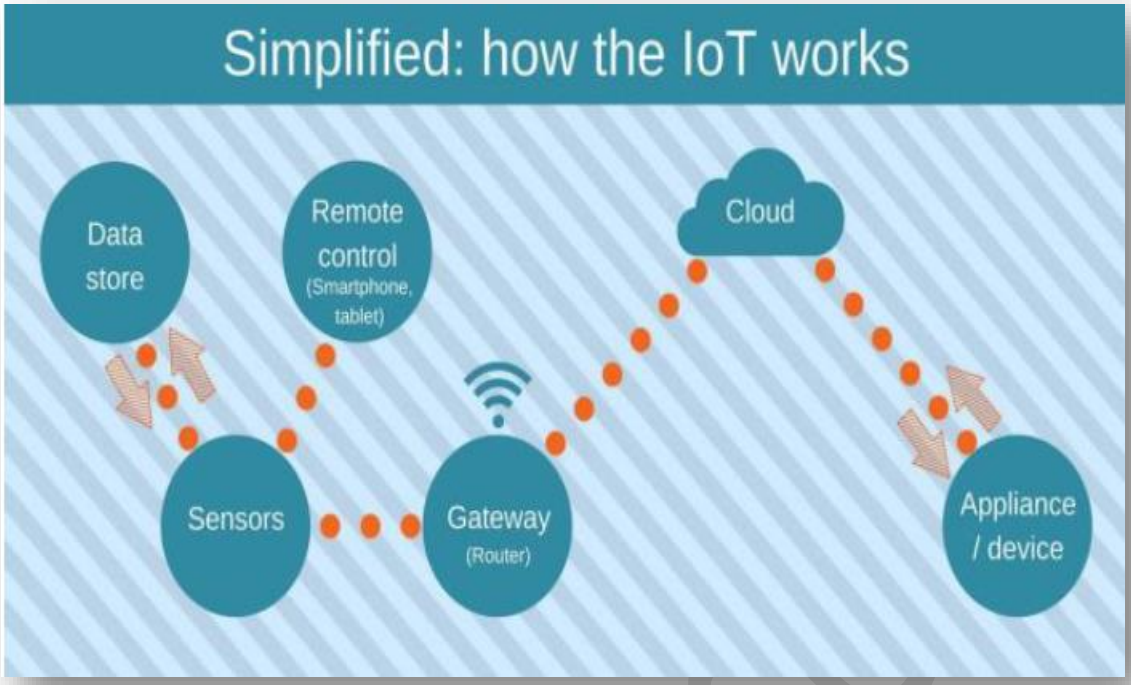

Figure 1. Working principle of IoT

For the hardware parts, LM 393 sound sensor is used to read the readings of the sound level from the environment. The reading of sound sensor is calibrated using the real sound level meter to get the accurate readings of the sound level.

The 16x2 LCD will show the values of sound level at that researched area and give the warning that says the level of sound is high when the measurement exceeds the set value. If the users could not read the readings due to poor eyesight, they can know the level of sound by using the light emitting diodes (LED) which in red, blue and green colour placed below the LCD.

LED acts as an indicator to indicate when the noise is very high. It will turn to red, blue for low noise while green for intermediate level. All these components such as sound sensor, LCD, and LEDs will be connected to the ESP8266 NodeMCU.

Figure 2. Prototype of the Project

Components Required:

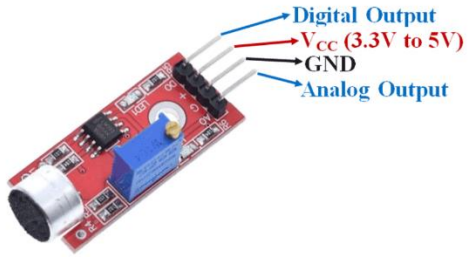

Figure 3. LM393 Noise Sensor

Figure 4. 16x2 LCD Display

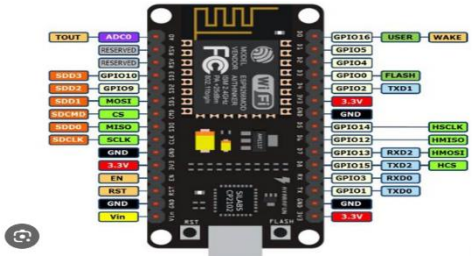

Figure 5.ESP8266NodeMCU

3.Noise Pollution Information Platform:

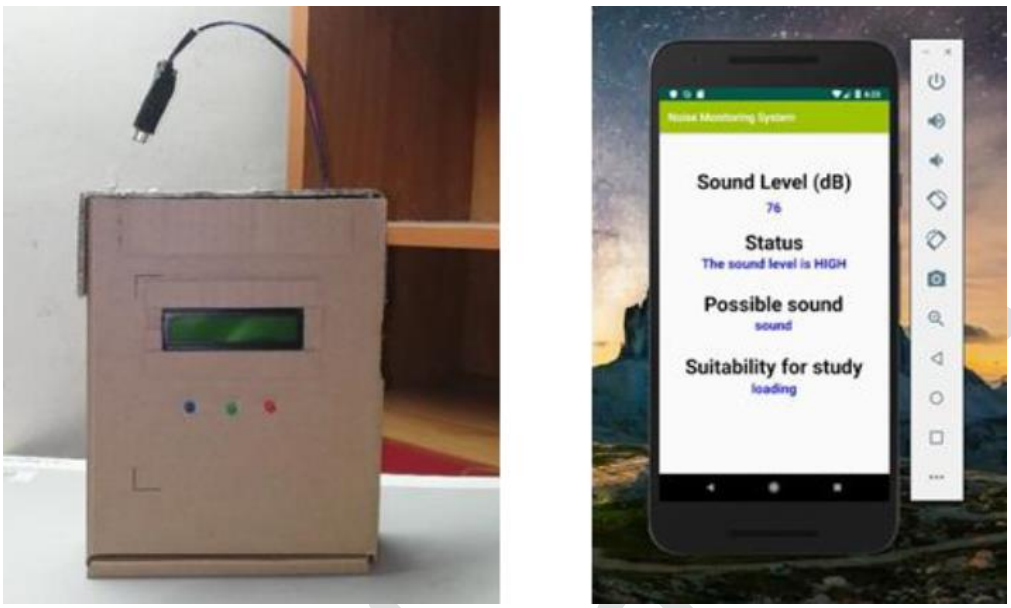

Figure 6. Prototype of the Project and interface of the app on mobile smartphone

3.1 App Development

As the app was created by using Android Studio, the app will display the data taken from the sound sensor. Android Studio is a software to create app use JAVA language to design an Android development. The app has four features which are the reading of sound level in dBA, the level of warning based on the reading of sound intensity, the possible sound that contributes to the sound level and the suitability for students to study. The app gives different level of warning such as “low”, “normal”, “high” and “very high”.

4. Integration Approach:

The prototype is calibrated using actual sound level meter to get the accurate measurement of sound level or sound intensity.
The prototype is used to measure the sound level at five different times which are during morning, afternoon, evening, night and midnight at a place where UTM students are staying. The reading is taken 30 minutes per range of time. Within that time, the lowest and highest sound intensity were recorded and from the readings, the range of sound level was determined during that specific range of time.

Table 1. Data Analysis from Prototype.

Time	Weekend (Saturday) (dBA)	Weekday (Sunday) (dBA)	Allowable Noise Level according to Environmental Department of Malaysia (dBA)	Permissible Level of Comfort according to CIBSE (dBA)
Morning 7.00am-12.00pm	47 – 60	57 – 71	55	60
Afternoon 12.01pm-14.00pm	43 – 49	54 – 69	55	60
Evening 2.01pm-7.00pm	43 – 49	62 – 69	55	60
Night 7.01pm-12.00am	42 – 59	48 – 63	55 (7.01pm–10.00pm) 45 (10.00pm– 12.00am)	60
Midnight 12.01am-6.59am	34 – 35	34 – 35	45	60

5. Conclusion

People thought that noise pollution is merely an annoyance but it is actually very important to monitor noise level because according to research, people who are exposed to noise for a long duration of time can have hearing loss, sleep disturbance, high blood pressure and injuries [16].

Besides, it can affect the learning process of people in terms of understanding and behaviour. Thus, this research investigates and subsequently proposes the suitable time for students to study by utilising the cloud server and android application to realize an IoT based noise monitoring system.

From the prototype, it also can be determined the dominant sound that increases the noise level in the researched area. The app can display the reading from the prototype successfully.

Based on the results, it can be concluded that the students can study throughout the day starting from morning until midnight during weekends because the noise level is still under the allowable standard which is 60dBA according to CIBSE.

As for weekdays, the suitable time to study is found out to be at midnight because the readings are below 60dBA for that time. The limitation of this study is that it is conducted within UTM campus only.

In addition, the app can only show the reading from only a single prototype as well as the prototype and app can only operate when there is an internet connection. This system can be improvised in future to include measurements outside UTM such as at schools and airports.