SOUND POLLUTION MONITORING SYSTEM

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Abstract —

Cities and ecosystems worldwide face environmental and technological issues due to air and sound pollution and a shortage of sound pollution monitoring locations. To solve these issues, the industry has focused its efforts on building a flexible technology solution that allows for improved air quality assessment and the supply of reference values in network locations where traditional monitoring falls short. Unfortunately, existing items and their outcomes are not low-cost alternatives. IoT has proven itself in a variety of domains by aiding society, including defense, agriculture, safety, comfort, etc. Pollution is steadily increasing these days, having a severe impact on society. Different types of pollution cause different issues.

Keywords — Environmental science, Wireless network Communication system, Node MCU, Buzzer, Arduino IDE, LED, IoT.

I. INTRODUCTION

Sound pollution is caused by the increased use of machinery and resources as a result of industrialization. Sound pollution hurts both humans and animals. Sound pollution is becoming a bigger problem, therefore it's important to keep an eye on it for a brighter future and a healthier lifestyle for everyone. In recent years, pollution has had a direct impact on people's health.

We've suggested a IoT technology-based sound pollution monitoring system which would allow us to track and monitor noise levels in real time in any given place. The system keeps measuring noise level and reports it. It uses (Sound sensor LM393) that detects noise levels and responds appropriately by glowing the LEDs. When the sound limit exceeds a certain high limit, a buzzer also turns on along with the LEDs. In this proposed system Node MCU, LED, Buzzer, Sound sensor is used. Arduino IDE is the coding software utilized. The “HIGH” and “LOW” values displayed on the webpage for the sound values will determine whether the sound level is under control or not.

II. LITERATURE REVIEW

The air and sound pollution monitoring system is critical for detecting a wide range of gases; also, sensors have a long-life span, are readily available, are inexpensive, easy to use, and are compact. Air quality can be measured both indoors and outdoors. This system features a basic drive circuit, real-time operation, and visual output. The main goal of this document is to ensure that air and sound pollution are monitored and controlled by taking appropriate measures. The proposed paper has several limitations. 22 Humidity should be less than 95%, and precise measurements of harmful gases in ppm are impossible to detect. This paper can be used to monitor pollution levels as well as to prevent excessive pollution, which could lead to major difficulties in the future. This paper outlines how we can provide authorities with immediate alerts. The IoT technology is adopted because it is cost-effective. As a result, this technology is used to monitor air and sound pollution. [2]. The Automatic Air & Sound Management System is a step forward in providing a solution to the most pressing problem. The air and sound monitoring system solve the problem of heavily polluted places, which is a significant problem. It encourages the use of new technology while also emphasizing the need of living a healthy lifestyle. This system includes elements that allow consumers to monitor pollution levels on their mobile phones via an application.

As a result, monitoring the environment by municipal officials and civilians becomes very dependable and efficient. Allowing civilians to participate in this process adds to its worth. This concept of IoT is important for the well-being of society because citizens are now equally informed and curious about their environment. It is also implemented using cutting-edge technologies. [5]

The author[6] demonstrates that both the local residents and the government have access to the Air and Sound Pollution Monitoring equipment. The device will be installed via a mobile application that will display real-time updates on the degree of pollution in the vicinity. The mobile applications will also be installed in the fire brigades themselves so that if a fire is taking place nearby, it can be controlled in time to minimise loss of life and property. This

device is also capable of detecting the fire in its area and notifying the fire brigade authorities so that they can take the necessary actions accordingly. The IOT, a growing field of technology based on the combination of electronics and computer science, is how this system operates
The authors of [7] illustrate a flexible and distributing approach for controlling the framework associated to the environment. The system is built with a four-layer architecture and a separate module for monitoring sound and air pollution, among other functions. Information is provided on the parameter for monitoring and controlling noise and air pollution in layer 1. An actuator in Layer 2 is made up of its functional properties and traits. Actuators' data ownership and decision-making will take place in layer 3, and rational surroundings will occur in layer 4. The author [9] presents measurement results obtained by an MCS solution for air and noise pollution monitoring by means of wearable sensors and mobile application Mobile community sensors enable citizens to collect and share sensor data on the move in urban environments. MCS services can produce dense sensor readings and provide means to discover new phenomena in urban environments. Noise and air pollution can be related and are strongly dependent on the traffic exposure, according to researchers at the University of Zagreb in Croatia. The average noise level is almost 3 decibels higher during peak hour and NO2 concentrations are significantly lower during off-peak hour.
The author [10] presents a mobile crowdsensing (system for monitoring noise pollution and air quality. More specifically, from sensor calibration through data collecting and processing, they have demonstrated real-world deployment experience. Initial findings indicate a strong correlation between air and noise pollution, which is worse during rush hours because there are more vehicles on the roads.

III. METHODOLOGY/EXPERIMENTAL

The proposed system uses Sound Sensor, Microcontroller unit i.e., Node MCU which is also a data transmission module ESP8266 Wi-Fi module. The components used in this proposed system are shown in Table.1. along with their purpose in this proposed system.

Component Name	**Purpose**
Node MCU	Microcontroller board
LEDs	Glows when sound is above the desired value
LM393 (sound sensor)	To detect the sound
Breadboard	To connect all the components
Power Supply	To give power to model
Buzzer	Beeps when sound is above the desired level.

Table.1. List of components

The Microcontroller Unit is a significant part of the system which is developed for Sound Monitoring, Node MCU is quite a small size, compatible with IoT projects. MCU has an on-chip ADC which converts the output analog signal of the sensors to digital signals. So, to get this analog output from the sensor, the sensor's analog output will be connected to the analog pins of MCU. All the sensor data is processed by the MCU and updated to the BLYNK server using the Wi-Fi data communication module ESP8266 (Node MCU) to the central server. Node MCU detects the value of the sound sensor in decibels and further, an average value is set above which the value of sound is said to be "HIGH" which is displayed on the LCD screen. Also, if the value of the sound sensor is more than the desired value then the LEDs bulb glows. It can be seen from the block diagram in Fig. 1, that in the proposed module sound sensor is used to measure sound level in the surrounding. The sensor input is further processed through Node MCU and then sent to BLYNK server. LEDs connected to the Node MCU operates on the value of the sound sensor. If the level of sound is below the value of 200, none of the LED's glows. If the sound level is between 200 and 500, GREEN led glows while if the sound level is between 500 and 700, YELLOW led glows and if the level of sound is above 700, RED led glows and along with the LED, the buzzer also starts to beep indicating that the level of sound has increased to a greater extent.

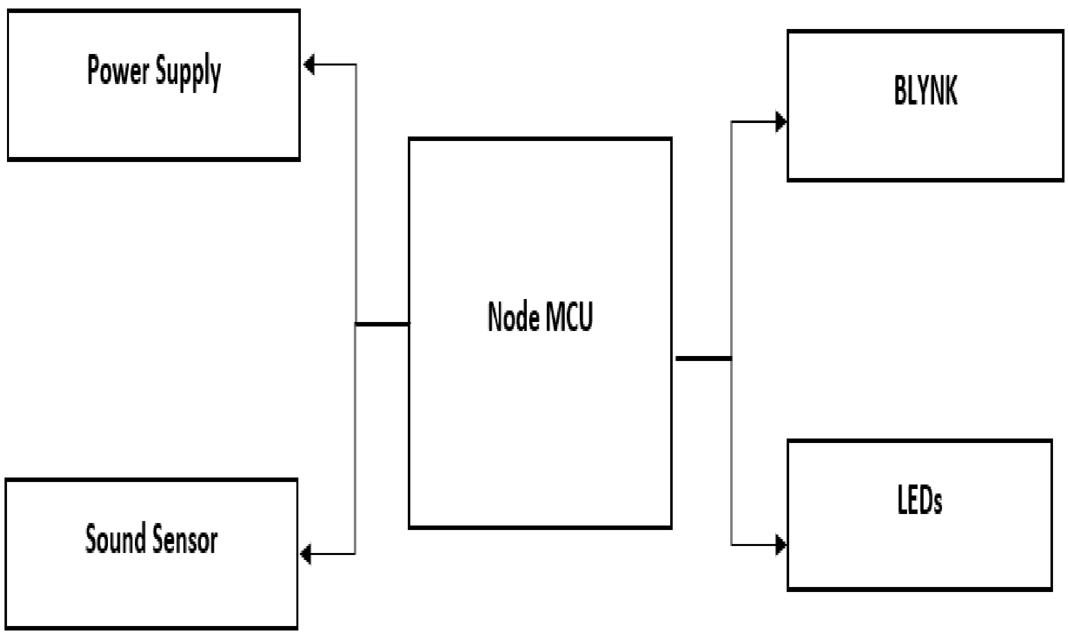

Fig.1. Block diagram of the model

IV. Flowchart for the Proposed Model

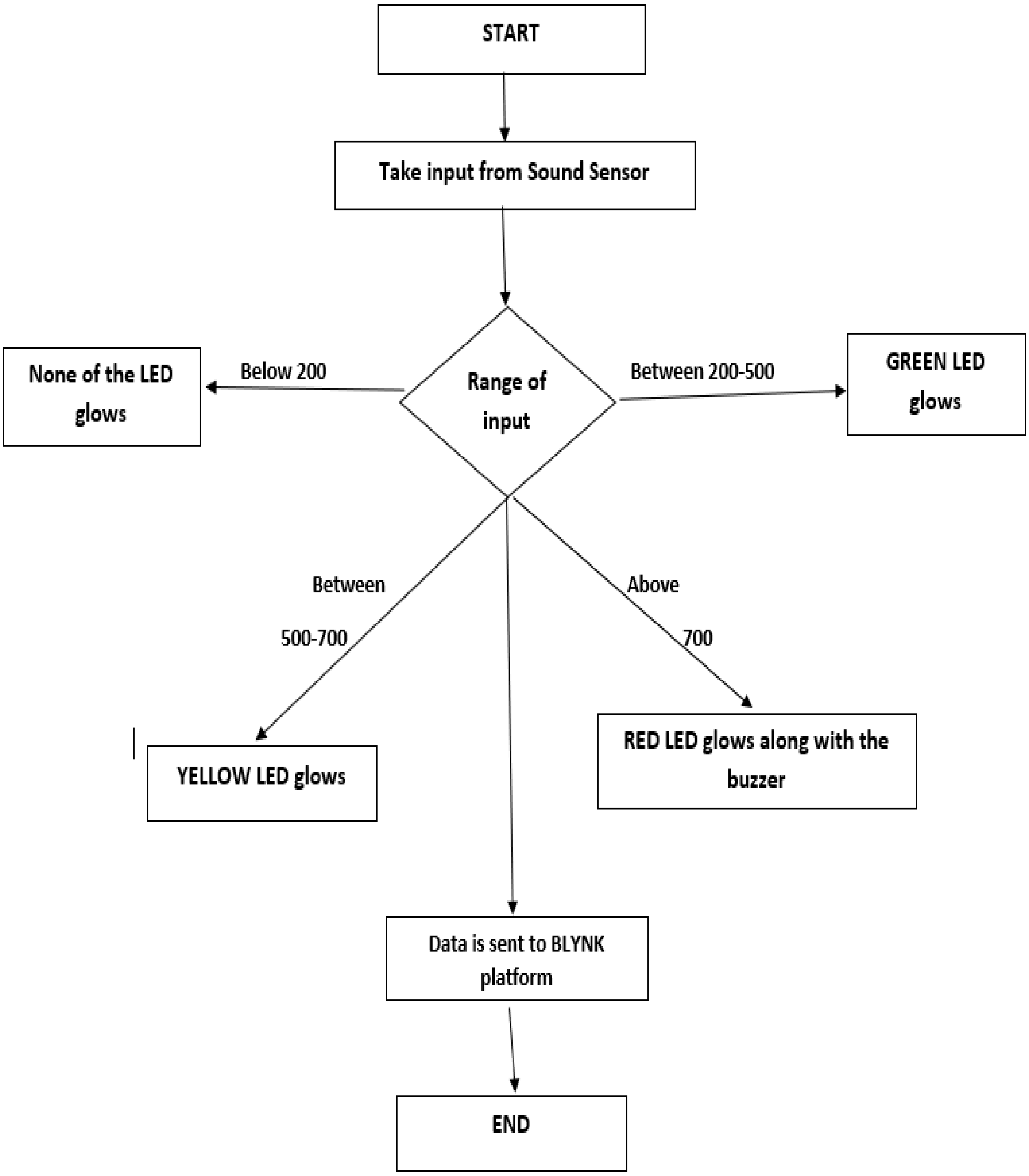

Fig.2. Flowchart for sound pollution monitoring system

The proposed model has to monitor the environmental sound pollution level. In Fig.2. a flowchart depicts how the sound sensor is working in the model. A sound sensor is used to detect sound levels in a particular area. If the level of sound is below the value of 200, none of the LED's glows. If the sound level is between 200 and 500, GREEN led glows while if the sound level is between 500 and 700, YELLOW led glows and if the level of sound is above

700, RED led glows and along with the LED, the buzzer also starts to beep indicating that the level of sound has exceeded a greater extent.

V. . HARDWARE IMPLEMENTATION OF THE PROPOSED MODEL

The hardware prototype of the portable Node MCU based environmental sound pollution monitoring system with embedded sensors is shown in Fig. 5. The sound sensor's Analog pin is connected to the A0 pin of the Node MCU board. To display the sound readings, the BLYNK application is connected to Node MCU Microcontroller. The analog pins of the board are used as input pins and the digital pins are used as output pins. Here pin A0 of the board is set as input. When a sound is sensed by the sensor, it produces an analog voltage which is sent to the Node MCU'S analog pin A0. LEDs are connected to Node MCU to display the output. Then after processing the data sensed by the sensor through Node MCU, led glows when the sound level exceeds the desired level and the level of the detected sound can be seen remotely on the BLYNK platform as well as in the BLYNK mobile application. A buzzer is also connected to the Node MCU using the jumper wires which will also beep when the sound value reaches a certain larger extent.

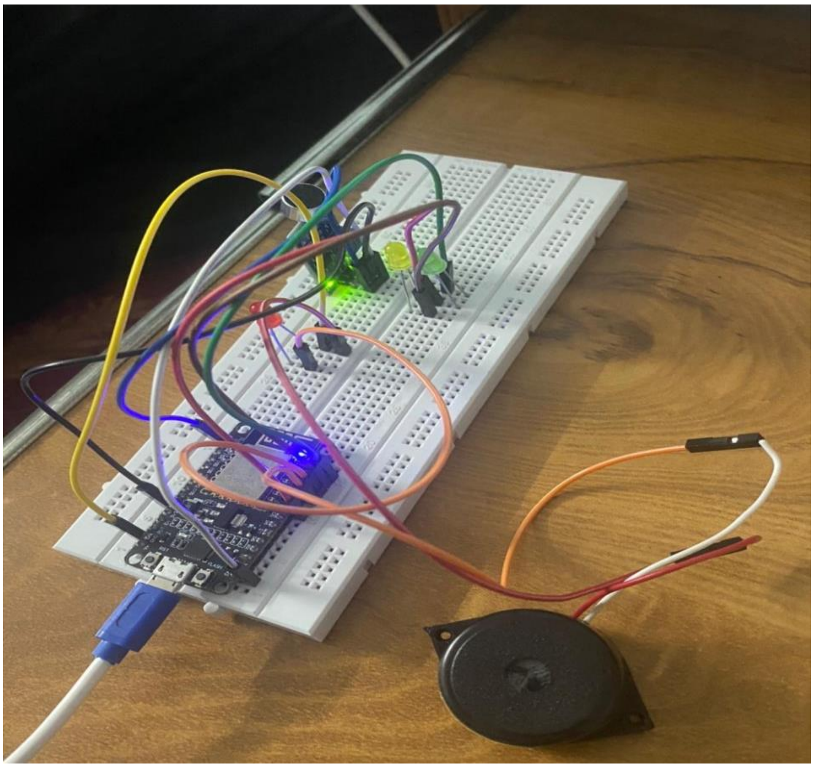

Fig.5. Module for sound pollution monitoring system.

VI. RESULT ANALYSIS

The proposed model is used for measuring the sound pollution/intensity level near educational institutions, hospitals, housing societies, and corporate offices. For measuring the pollution level, we chose society.

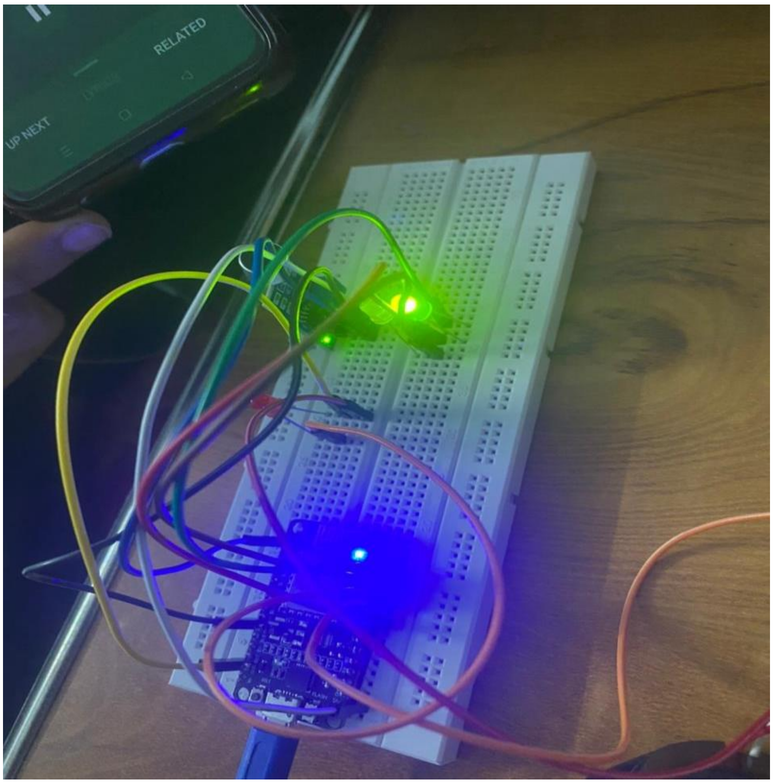

Fig.6.When the sound level is between 200-500

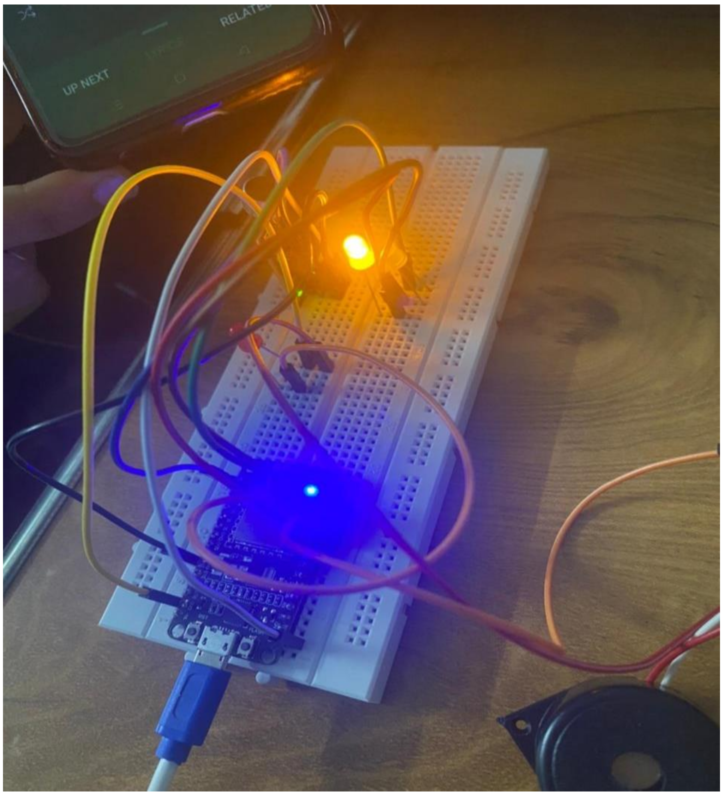

Fig 7. When sound level is between 500-700

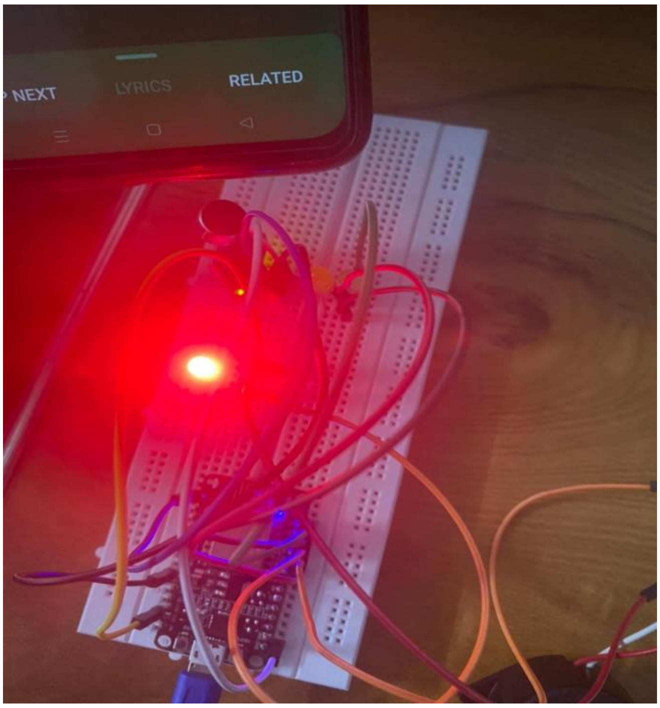

Fig 8 When level of sound is above 700

In the case of Fig 8. A buzzer also starts to beep until the level of sound does not reduces below the above value.

Fig.9. is an interface of a BLYNK application where a Gauge is being used to display the level of the sound detected. A display is also being used to show the exact value of the sound captured by the LM393 sound sensor

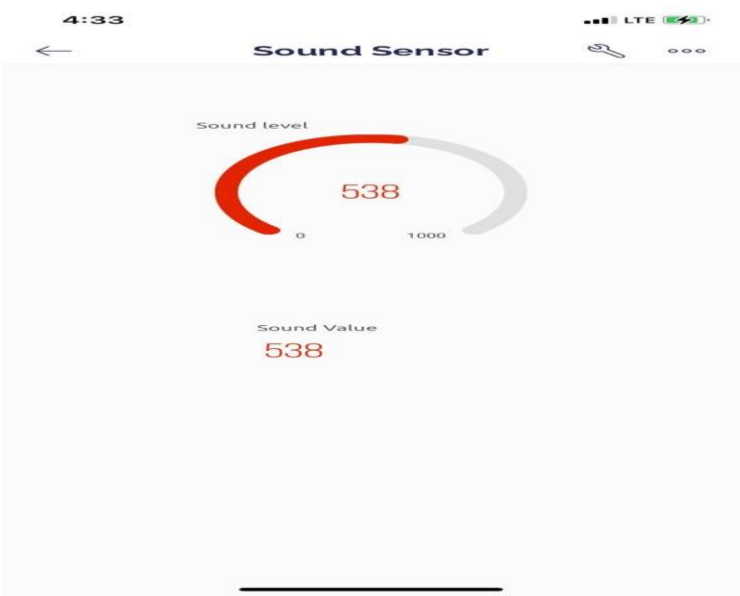

Fig.9. BLYNK mobile application interface

VII. Limitations

Since these devices are connected via the internet, there is a possibility that these devices can be hacked and externally monitored. The devices can be tracked by hackers which they can use for their benefit. It will expose the recorded data and if any small vulnerability is found, other devices are at risk of getting hacked.

VIII. Conclusion

This technology assists in sensing the level of noise in the environment and providing relevant warnings to people. It can also be used in combination with an air monitoring system to enhance its use. This system is fully helpful to save lives and overcome all the problems related to the environment.

To improve this project, even more, we may add a air pollution monitoring system which will make it even more beneficial for our use. The information can then be utilized to make observations and draw inferences about the area where the product is situated. These devices can be deployed in a variety of locations, and alert messages can be transmitted immediately to the appropriate authorities, who can then take appropriate action to minimize the issue.

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