IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 10, October 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.625

© 2024 IJIRCCE | Volume 12, Issue 10, October 2024| DOI: 10.15680/IJIRCCE.2024.1210034

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

Safe Pit: IOT Enabled Manhole Surveillance for Enhanced Infrastructure

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ABSTRACT: The fast urbanization and extension of framework have expanded the quantity of sewer vents in urban areas, which, when left unattended or inappropriately kept up with, can present critical wellbeing risks to walkers and vehicles. The "Protected Pit: The goal of the "IoT-Enabled Manhole Surveillance for Enhanced Infrastructure" project is to solve this problem by creating a smart monitoring system that makes use of Internet of Things (IoT) technology to make sure manholes are safe and secure. The system includes ultrasonic, gas, infrared, and GPS sensors that are connected to an ESP8266 microcontroller to monitor and report real-time manhole conditions. The IR sensor monitors unauthorized access, the gas sensor detects the presence of hazardous gases, the ultrasonic sensor measures the water level within the manhole, and the GPS module provides location data. This coordinated framework guarantees brief identification and notice of expected perils, taking into consideration convenient mediations and worked on open security. This approach intends to forestall mishaps including sewer vents, limit natural dangers and guarantee the wellbeing of metropolitan framework. The research will look into the advantages of the proposed system, such as faster response times for maintenance crews, increased public safety through early detection of hazards, and optimal resource allocation by concentrating efforts on problem areas. By highlighting the potential of Internet of Things (IoT) technology in addressing critical issues that modern cities face, the goal of this research is to contribute to improvements in infrastructure management practices.

I. INTRODICTION

Because they provide access points for underground utilities like water, sewage, and communication lines, manholes are an essential part of urban infrastructure. Be that as it may, the absence of customary checking and support of these passages can prompt risky circumstances, including flooding, unsafe gas spills, and unapproved access. Conventional strategies for sewer vent observing are work escalated and frequently receptive instead of proactive, prompting deferred reactions to expected dangers. To address these difficulties, the proposed "Safe Pit" project use IoT innovation to make an extensive observation framework that constantly screens the states of sewer vents and gives continuous cautions in case of irregularities. The system's central unit for data collection and communication is an ESP8266 microcontroller. The ultrasonic sensor recognizes changes in water levels, demonstrating expected flooding. The gas sensor screens the air quality inside the sewer vent to distinguish the presence of hurtful gases, which could demonstrate a release or a risky condition. The IR sensor recognizes unapproved access or altering, and the GPS module gives exact area data, pivotal for brief crisis reaction.

II. EXISTING SYSTEM

The current system for monitoring urban manholes typically relies on maintenance staff performing manual inspections. These investigations are planned occasionally and frequently include genuinely opening the sewer vent covers to survey the state of the foundation and distinguish any issues, like blockages, spills, or underlying harms. Nonetheless, this approach has a few restrictions, including the powerlessness to give continuous information, postponed reaction to possible risks, and expanded work costs. When dealing with hazardous conditions like toxic gas leaks or high water levels, manual inspections also present safety risks to the personnel involved. Furthermore, on the

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grounds that investigations are not consistent, there might be critical holes between when an issue emerges and when it is identified and tended to, prompting possible mishaps or foundation disappointments.

III. PROPOSED SYSTEM

The proposed system makes use of Internet of Things (IoT) technology to enable continuous, real-time monitoring of manholes in order to circumvent these limitations. Ultrasonic sensors for measuring water levels, gas sensors for detecting hazardous gases, infrared sensors for monitoring unauthorized access, and a GPS module for location tracking are all part of the system. An ESP8266 microcontroller collects and processes the data from these sensors before wirelessly transmitting it to a cloud-based server. The server investigates the information and produces alarms on the off chance that any inconsistencies are recognized, for example, rising water levels, the presence of poisonous gases, or unapproved access. With this strategy, potential dangers can be identified and reported immediately, allowing for swift responses and preventative measures. The proposed system increases public safety, lowers costs associated with maintenance, and ensures more effective management of urban infrastructure by providing continuous surveillance.

IV. LITERATURE SURVEY

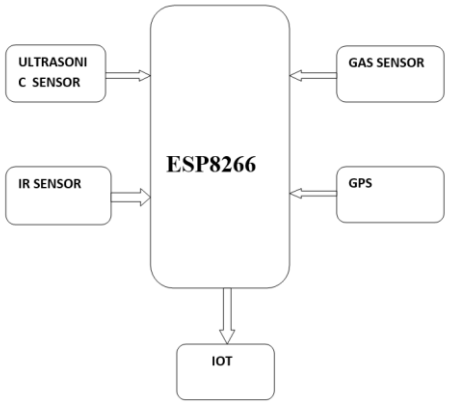
4.1. By Drs. Alex Turner, Emily Zhang, and Liam Anderson, Smart Monitoring of Urban Manholes Using IoT and Wireless Sensor Networks

Abstract:
The smart monitoring of urban manholes through the use of IoT and wireless sensor networks (WSNs) is the subject of this study. In order to collect data in real time, the proposed system makes use of a variety of sensors, including gas, temperature, and water level sensors. A wireless sensor network (WSN) connects the sensors and sends data to a central server. The data is analyzed by the server, which sends alerts for any found anomalies, like gas leaks or high water levels. The review exhibits that the utilization of IoT and WSNs altogether works on the proficiency and viability of sewer vent checking, diminishing the reaction time to likely dangers and forestalling mishaps.

4.2. Dr. Rachel Kumar, Dr. Mark Liu, and Dr. Priya Singh's Automated Hazard Detection and Alert System for Manholes Using IoT

Abstract:
An IoT-based automated hazard detection and alert system for manholes is presented in this paper. Ultrasonic sensors for water level detection, gas sensors for hazardous gas monitoring, and temperature sensors for fire detection are all incorporated into the system. Information from these sensors are communicated by means of an IoT stage to a cloud-based server, where it is dissected for unusual circumstances. In case of an identified risk, the framework sends robotized cautions to the significant specialists through SMS and email. The execution of this framework in a genuine situation shows a significant improvement in the convenient ID and the board of sewer vent related dangers.

V. BLOCK DIAGRAM



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VI. HARDWARE COMPONENTS REQUIRED

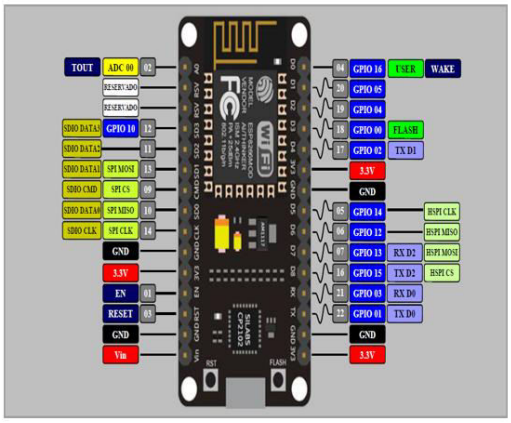
- ESP8266
- Ultrasonic sensor
- Gas sensor
- Ir sensor
- Gps

VII. SOFTWARE REQUIRED

Arduino ide

VIII. HARDWARE DISCRIPTION

8.1ESP6266



The ESP8266 is an extremely easy to understand and minimal expense gadget to give web network to your ventures. Because the module is able to function both as an access point (which can create a hotspot) and as a station (which can connect to Wi-Fi), it is able to quickly retrieve data and upload it to the internet, making the Internet of Things as simple as it can be. It can also use APIs to get data from the internet, making it possible for your project to access any information on the internet and making it smarter. This module's ability to be programmed with the Arduino IDE, which makes it significantly more user-friendly, is yet another exciting feature. Anyway this form of the module has just 2 GPIO pins (you can hack it to utilize upto 4) so you need to utilize it alongside another microcontroller like Arduino, else you can look onto the more independent ESP-12 or ESP-32 renditions. So in the event that you are searching for a module to begin with IOT or to give web network to your venture then this module is the ideal decision for you.microcontroller with integrated Bluetooth and Wi-Fi capabilities. It is suitable for a wide range of applications that require high processing power, connectivity, and energy efficiency because it has a dual-core processor with clock speeds up to 240 MHz based on the Tensilica Xtensa LX6. The ESP32 is furnished with numerous advanced and simple info/yield (I/O) pins, which can connect with different sensors, actuators, and other electronic parts. The board is regularly modified utilizing the Arduino IDE, giving simplicity of improvement and admittance to a huge swath of libraries and local area support.

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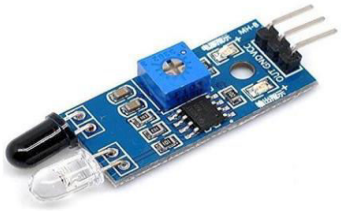
8.2 ULTRASONIC SENSOR

Ultrasonic sensors serve the market by offering a low-cost method of sensing that also possesses unique characteristics that no other sensing technology possesses. By utilizing a wide assortment of ultrasonic transducers and a few different recurrence runs, a ultrasonic sensor can be intended to take care of numerous application issues that are cost restrictive or basically can't be tackled by different sensors. Long reach discoveryMore and more applications in industrial sensing require distance detection. Limit switches and inductive sensors cannot detect over long distances of up to forty feet.

8.3 IR SENSOR



An electronic device that emits in order to detect some aspects of the environment is known as an infrared sensor. In addition to detecting motion, an IR sensor can also measure an object's heat. A passive IR sensor, on the other hand, measures only infrared radiation rather than emitting it. In most cases, all objects emit some kind of thermal radiation in the infrared spectrum. An infrared sensor can pick up these kinds of radiations, which aren't visible to our eyes but can be detected. The detector is merely an IR photodiode that is sensitive to IR light of the same wavelength as the IR LED. The emitter is merely an IR LED (Light Emitting Diode). The photodiode's resistances and output voltages will change in proportion to the magnitude of the received IR light when IR light hits it.

8.4 GAS SENSOR

Gas Sensor

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A Run of the mill human nose has 400 sorts of fragrance receptors empowering us to smell around 1 trillion distinct scents. However, many of us are still unable to determine the type or concentration of gases in our atmosphere. This is where sensors come in. There are many different kinds of sensors that can measure different parameters. For example, a gas sensor is useful in situations where we need to find changes in the concentration of toxic gases to keep the system safe and avoid or warn of any unexpected dangers. To detect gases like oxygen, carbon monoxide, nitrogen, methane, and others, a variety of gas sensors are available. They are also frequently present in devices that, among other things, are used to monitor the quality of the air in workplaces and factories and detect gas leaks.

8.5 GPS

GPS satellites circle the Earth two times per day in an exact circle. GPS receivers are able to decode and calculate each satellite's precise location thanks to its distinct signal and orbital parameters. This data and trilateration are used by GPS receivers to determine a user's precise location. The time it takes to receive a transmitted signal is basically how the GPS receiver determines the distance to each satellite. With distance estimations from a couple of additional satellites, the recipient can decide a client's situation and show it.

A GPS receiver needs to be locked onto the signal of at least three satellites in order to track movement and calculate your 2-D position (latitude and longitude). The receiver can determine your 3-D position (latitude, longitude, and altitude) with at least four satellites in view. Depending on the time of day and location, a GPS receiver may typically track eight or more satellites.

IX. SOFTWARE DISCRIPTION

9.1 ARDUINO IDE

ArduinoSoftware(IDE)

Programs composed utilizing Arduino Programming (IDE) are called draws. The file extension.ino is used to save these sketches, which were written in the text editor. The editor has tools for searching and replacing text as well as cutting and pasting. The message region gives input while saving and trading and furthermore shows blunders. The Arduino

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Software (IDE) outputs text to the console, which includes all of the information, including complete error messages. The base righthand corner of the window shows the designed board and sequential port. You can open the serial monitor, create, open, and verify programs, and upload and upload programs using the toolbar buttons.

X. CONCLUSION

In conclusion, urban infrastructure management has made a significant leap forward with the implementation of an IoT-enabled manhole surveillance system. The proposed system effectively overcomes the drawbacks of conventional manual inspection techniques by making use of a variety of sensors and transmitting data in real time. Manholes are monitored continuously and automatically by this smart monitoring solution, ensuring that flooding, toxic gas leaks, and unauthorized access are quickly identified and reported.

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INTERNATIONAL STANDARD SERIAL NUMBER INDIA

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