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MANHOLE MONITORING SYSTEM

[1]Y Sai Teja, [2]B Premsingh, [3]A Ranjith kumar, [4]N. Anupama Rani

[1]Student, [2]Student, [3]Student, [4]Assistant Professor

[1]Electronics and Communication Engineering,

[1]Sreenidhi Institute of Science and Technology, Hyderabad, India

Abstract: The sewage system must be monitored in order to maintain the city clean. Uneven sewage system monitoring causes drainage to become clogged. Blockages in the sewer system are a major source of sewer flooding and pollution. Workers may be involved in an accident as a result of their ignorance of the situation inside the manhole. To get the necessary output from the module, this model uses a regulator circuit, sensor driver circuit, microcontroller, serial communication devices, and IoT module. Our answer to this problem is an IoT system that warns municipal officials about overflowing drains immediately by notification at the city control centre, as well as citizens via a mobile app. The essential component of this system is a low-power IoT-based portable gadget that is mounted below the manhole cover. Nowadays, accidents due to broken and missing manhole covers are quite frequent. Manholes are not monitored properly in developing countries. These accidents can lead to serious injuries and also death. Hence, here we propose a system to overcome this problem. We have included an array of sensors for complete monitoring of the manhole cover so that such accidents can be prevented. This project includes a Tilt sensor, Level sensor for to measure the level of water which could need to crack information, a tilt sensor is introduced to indicate whether the manhole can tilt, in case of any alert due to any of the parameters we send an SMS to an APP trough wifi. Also, all the parameters are continuously updated on the APP.

Keywords: Manhole, Sewage, microcontroller, Atmega328P, Tilt Sensor, Level Sensor

I. INTRODUCTION

Manholes are essential components of urban infrastructure, providing access to underground utilities such as sewer lines, electrical cables, and communication lines. Unfortunately, manholes pose significant dangers, especially to pedestrians and motorists, due to their often-open and uncovered design. Many manhole accidents occur every year, leading to injuries and even death. There is a need for an efficient and reliable manhole detection and monitoring system that can prevent such accidents. The IoT-based manhole detection and monitoring system consist of several components, including sensors, wireless communication modules, and a web-based dashboard. The sensors used in the system include water level sensor, tilt sensor.

The water level sensor is a tool that detects an excessively high or low liquid level in a stationary container. The two types of liquid level measurement devices are contact type and non-contact type, respectively. The contact measurement we refer to as the input type water level transmitter outputs an electrical signal based on the height of the liquid level. It is currently a water level transmitter that is frequently utilised. Inclinometers, also known as tilt sensors, are devices that measure an object's slope, angle, or tilt based on gravity for a variety of applications.

The wireless communication modules used in the system include Wi-Fi, Bluetooth, and LoRaWAN. The sensors transmit the data they collect to a central control unit using wireless communication. The control unit processes the data and sends alerts to the relevant authorities if necessary. The web-based dashboard provides a graphical user interface for monitoring and management purposes. The dashboard displays real-time data and sends alerts to relevant authorities in case of any anomalies.

II Literature Survey

The city needs the trash management system to stay clean, prosperous, and secure. Inadequate leak maintenance can cause waste water to contaminate clean water, which increases the risk of infectious diseases spreading. The vast majority of metropolitan areas accepted an underground waste system to combat these problems. Demonstrate the essential development of the underground waste system. If garbage is not collected, it clogs roads, pollutes the environment, and if sewage vent tops are not closed properly, there is a chance of tragedies and accidents when people fall into the gushing sewage. The administrative station must embrace an inaccessible notice structure in order to allay these worries. In the midtown area, subterranean power connections are provided in recognition of the grandeur and success of the metropolitan networks. Sewer vent controlled by humans.

Several studies have proposed different approaches to detecting and monitoring manholes using various sensors and technologies. For instance, a study by Ahmed et al. (2018) proposed an RFID-based system for monitoring manhole covers, while another study by Alzahrani et al. (2019) proposed a vision-based system for detecting and monitoring manhole covers. However, these studies have limitations such as low accuracy, high cost, and limited scalability. In contrast, the proposed IoT-based system uses a combination of sensors and wireless communication technologies to overcome these limitations. In addition to the studies mentioned in the introduction, there have been several other efforts to develop manhole detection and monitoring systems using IoT technologies. For example, a study by Chen et al. (2019) proposed a system that combines ultrasonic and infrared sensors to detect the presence or absence of manhole covers and to monitor the temperature and humidity levels inside the manhole. The system uses a Zigbee wireless communication network to transmit the sensor data to a central server. Similarly, a study by Aslam et al. (2019) proposed a system that uses magnetic and pressure sensors to detect the presence or absence of manhole covers and to monitor the water level inside the manhole. The system uses LoRa wireless communication technology to transmit the data to a central server.

4/28/23, 12:15 PM Man falls into open drain, dies after four days - Times of India

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THE TIMES OF INDIA

Man falls into open drain, dies after four days

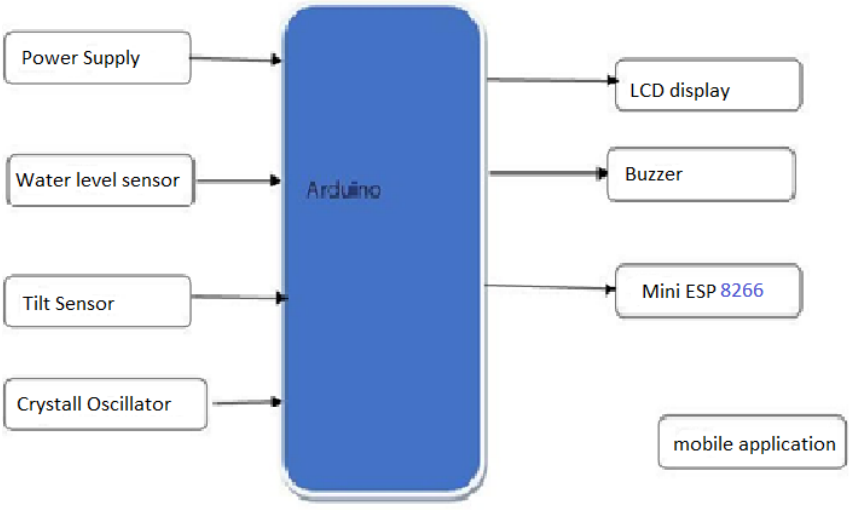
TNN | Jul 30, 2018, 02.38 AM IST

NEW DELHI: A 29-year-old youth died after slipping into an open drain near west Delhi's Mayapuri industrial area. The incident happened on July 25 when the youth was on his way back home. He had suffered injuries on his head and later succumbed.

The incident was reported from Phase I, JJ colony near the industrial area. Locals said the man, Arjun, was walking back to his house when the incident happened. They said that the road leading to the colony remains dark and it was flooded with drain water that had overflowed after the evening showers. "It was impossible to distinguish where the hole created by a broken slab over the drains was that day," said Rajesh Kumar, a neighbour.

Arjun slipped and fell into the drain, hitting his head on iron rods protruding out on the edges. A passerby saw him fall and alerted others, who pulled him out and took him to the DDU hospital.
Doctors told the family members that a rod had pierced through his head and referred him to the Safdurjung hospital where he died on Sunday.
Arjun had come to Delhi five years ago from a village in UP. He stayed with his wife Sunita and his child at a rented house at the JJ colony, and had a cart selling food items in the area.

2.1 Block Diagram of model



2.2 Project Description:

Tilt Sensor: Tilit sensor allow you detect orientation and inclination Their simplicity makes from popular toys gadgets and appliances Arduino UNO: Arduino is ATMEGA 32 processor-based controller Board. It is used to switch all the instruments and allocation the sensor signal.Water Level Sensor: A float switch is a sort of level sensor that detects the amount of liquid in a container. The sewage vent's obstructions and water level are detected by this structure. It also monitors the rate of continuous water flow. When a specific sensor reaches the individual edge level, the sensor's estimation will be sent off the microcontroller. This structure detects the obstacles in the sewage vent as well as the water level. It also keeps track of the constant water flow rate. The sensor's estimates get sent off the microcontroller when it hits the individual edge level.
Tilt Sensor: A part that can recognise an object tilting is the tilt sensor. However, it only functions as a pushbutton that is activated by a separate physical mechanism. The more environmentally friendly alternative to a mercury switch is this kind of sensor. It has a metallic ball within that, if the sensor tilts to a specific degree, switches the device's two pins from on to off and vice versa.

2.3 Implementation:

The proposed IoT-based manhole detection and monitoring system consists of several components. The first component is a set of sensors that are installed inside the manhole to detect the presence or absence of the manhole cover. These sensors can be either magnetic or pressure-based, depending on the specific application requirements. The second component is a microcontroller that processes the data from the sensors and communicates with the third component, which is a wireless module that transmits the data to a central server. The fourth component is a central server that receives and processes the data from the sensors and provides real-time updates on the status of the manhole covers. To implement the system, the sensors are first installed inside the manhole and connected to the microcontroller. The microcontroller is programmed to process the data from the sensors and communicate with the wireless module. The wireless module can be either WiFi or cellular, depending on the availability of network infrastructure in the area. Once the data is transmitted to the central server, it is processed and analyzed using machine learning algorithms to detect any anomalies or issues with the manhole cover. The data is also stored in a database for historical analysis and trend identification.

III. Sensor Selection and Placement

The selection and placement of sensors play a crucial role in the effectiveness of the manhole detection and monitoring system. The tilt sensors are installed on the manhole covers to detect any movement or tampering with the cover. The sensors must be sensitive enough to detect any activity but not trigger false alarms. The level sensors are placed inside the manhole to monitor the water level. The sensors must be placed inside the manhole in such a way that it detect the level of the water.
When the level of the water reaches certain threshold level it should send the message to app via Wifi or Bluetooth.

3.1 Wireless Communication:

The wireless communication modules used in the system include Wi-Fi, Bluetooth, and LoRaWAN. Wi-Fi is used for short-range communication, while Bluetooth is used for very short-range communication. LoRaWAN is used for long-range communication. The selection of the communication module depends on the range and data rate requirements. Wi-Fi and Bluetooth are suitable for short-range communication within a building or a small area. LoRaWAN is suitable for long range communication over a wide area.

3.2 Data Processing and Management:

The central control unit is responsible for processing the data collected from the sensors and sending alerts to the relevant authorities if necessary. The control unit must be able to handle large amounts of data and process it in real-time. The data must also be stored securely to prevent unauthorized access or tampering. The web-based dashboard provides a graphical user interface for monitoring and management purposes.

3.3 System Performance:

The proposed IoT-based manhole detection and monitoring system offers several advantages over traditional approaches. Firstly, the system can operate autonomously without requiring any human intervention, thus reducing the costs associated with manual inspections. Secondly, the system can provide real-time data on the status of manhole covers, allowing for faster response times in case of any issues. Thirdly, the system can collect and store historical data on the status of manhole covers, enabling city authorities to analyze trends and patterns over time.

IV. Future Directions:

While the proposed system offers several advantages, there are still several areas that require further research and development. For example, the system could be further optimized for power consumption to extend the battery life of the sensors and microcontrollers. Additionally, the system could be integrated with machine learning algorithms to improve the accuracy of anomaly detection and reduce false alarms. Finally, the system could be extended to monitor other types of urban infrastructure such as streetlights, traffic lights, and parking meters, to provide a more comprehensive view of the city's infrastructure. Another area of interest is the integration of the manhole detection and monitoring system with other smart city systems, such as traffic management, waste management, and energy management systems, to create a more comprehensive and integrated smart city infrastructure. The integration of different systems could enable city authorities to optimize their operations and make data-driven decisions based on real-time insights. Finally, further research is required to address the potential cybersecurity threats associated with IoT-based infrastructure monitoring systems. The development of secure and resilient IoT-based systems that can protect against cyber attacks and data breaches is crucial to ensure the safety and security of our cities.

4.1 Limitations:

While the proposed IoT-based manhole detection and monitoring system offers several advantages, there are still some limitations to be considered. Firstly, the system relies on the availability of network infrastructure, which may not be available in some remote or underdeveloped areas. Secondly, the system may be vulnerable to cyber attacks or data breaches, which can compromise the integrity of the data and the security of the system. Thirdly, the system may require regular maintenance and calibration to ensure accurate and reliable data collection.

V. Conclusion

In conclusion, the proposed IoT-based manhole detection and monitoring system offers significant benefits in terms of improving the safety and security of urban infrastructure. The system can provide real-time updates on the status of manhole covers, enabling city authorities to respond quickly to any issues and prevent accidents. Future research and development could focus on improving the accuracy and reliability of the system, integrating it with other smart city systems, and addressing the potential cybersecurity threats associated with IoT based Infrastructure monitoring systems.

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