

Smart Manhole Surveillance System Using Iot

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Abstract

This current project pushes the existent technology in manhole detection and creates an integrated design employing multiple different sensors and communication cards working in conjunction with an Arduino microcontroller. A gas sensor is installed to be able to identify dangerous gases released by the manhole hence protecting both pedestrians and workers on the ground. A tilt sensor is applied to detect manhole cover positioning and any positional anomalies or tampering in that area will be alerted at an early stage. An ultrasonic sensor defines location metrics in terms of distances, to the manhole, which improves spatial localization. The data in real time can be analyzed on a site by an LCD screen. Moreover, there is a GSM module that allows remote control and a prompt notification of specific authority employees upon emergencies. In combination, these elements provide a sturdy blueprint of manhole safety management that grants additional security to the citizens and reduces the dangers associated with maintenance of urban infrastructure.

INTRODUCTION

Access points form part of any efficient drainage system and provision of access points by drainage companies forms dyke entry and exit points in cleaning, clearing, and inspection of the drainage system. With reference to urban centers whereby underground drainage system dominates, the major role of keeping the system clean lies with the municipal corporation. Poor sewage maintenance can lead to the contamination of ground water which intensifies the risks of transmission of infections diseases. Every year during the rainy season especially, the clogged drains can interfere with the normal lives of society. In this regard, the municipal corporation must use a facility that could identify and inform with accuracy about where the blockage in the sewer system is detected. This system would further also play a significant role in warning the community about any gas explosion, water or temperature highness, hence, showing the efficiency of Internet-of-Things (IoT) technologies in extensively automating drainage monitoring. The sensor devices fitted along the network can be used to collect the data and relay it via GSM and GPS modules should be sent to some authorities.

LITERATURE SURVEY

2.1 IOT based manhole detection and monitoring system using Arduino

Proper management of manholes is an eminent feature of an efficient metropolitan communities. Currently, weaknesses in their design, maintenance, and drainage become the main challenges within the framework of smart-cities. Moreover, the presence of human contact with contaminated water due to malfunctioning sewage drainage systems is a very grave issue to the health of the population. According to empirical surveys, it is found that a greater percentage of manhole covers are installed in wrong places, and equal percentage of the covers is damaged. This increases the chances of road-traffic accidents and risks the safety of pedestrians. The overriding aim of the suggested study is to establish a viable accident-prevention system by making sure that large cities cannot have open manholes. To attain this purpose, tilt sensors would be embedded in a system which identifies the structural damages and reports back operational data to the municipal corporation officers and local councillors thus localising the locations of manholes. Monitoring of operations and

repairable fixes are enabled by means of Internet of Things platform. The implementation of this combined solution will add value in boosting the welfare of the community.

2.2 IOT Based Manhole Detection and Monitoring System

Smart underground infrastructure is a part and parcel of a smart city. Specifically, the strong control over the manhole system is crucial to the urban health and cleanliness. With that perspective, this paper proposes an innovative IOT-based manhole detection and monitoring. The application placed within manholes equips sensors that can gain information about a number of parameters. The data are then relayed via the IOT infrastructure to a shared digital platform. Therefore, the offered design would reduce the possibility of accidents and streamline maintenance procedures by presenting relevant data about the manholes state in a timely manner.

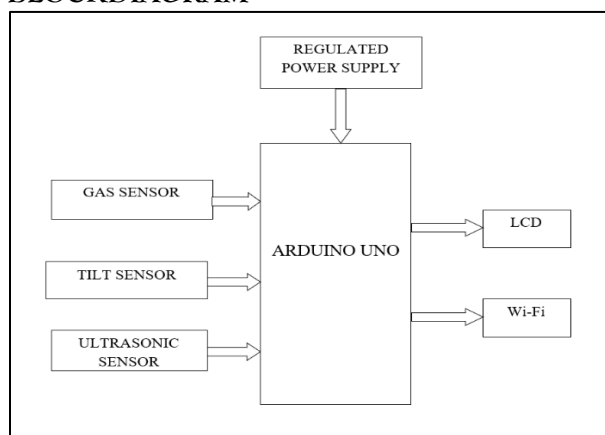
2.3 MANHOLE MONITORING AND DETECTION

The worsening nature of road traffic jams has created significant effects on people, economy and environment especially in urban areas of most big cities around the world. A roadway is traditionally used to separate mass inbound and outbound transportation vehicles in a stream of traffic. With the increment in the population, the number of vehicles has risen which exceeds the number available road infrastructure; therefore, the percentage of commuters that is affected by traffic congestion is increased. The main aim of the current research is to utilize all the precious seconds to protect the human life in case of emergency transportation. This target is achieved with the help of a mobile, actively translocable road divider. Unlike other automated systems, the suggested model will have its own standalone controller with inbuilt sensors, hence, eliminating the requirement of any other separate equipment. Traffic congestion on roads is one of the most threatening issues that both the authorities of the roads and the citizens face due to its significant implications. The first of these is the time delay that occurs when emergency services are called out to an incident site and this cost is paid in the form of deaths, injuries and costs incurred in the event of fires, automobile crashes and incidents of terrorism.

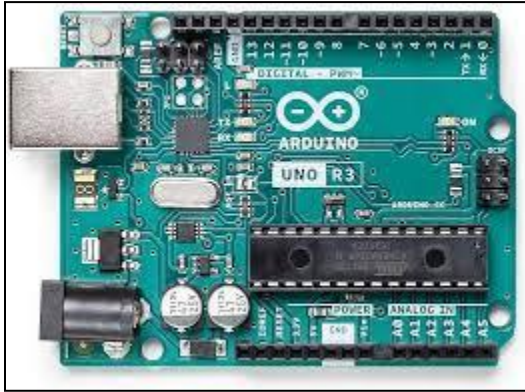
PROPOSED SYSTEM

The role of underground drainage monitoring systems in the context of urban space becomes central, on the one hand, to the preservation of the population and, on the other hand, to the preservation of the city in terms of its infrastructure. These systems are not only a way to offset the risk on the environment but also lower the administrative overheads of the municipal staff. Towards such an end, the following sensors are installed: manifold flow, manifold level, manifold temperature and gas concentration; all paired with an Arduino Uno microcontroller. When the values of the sensors go above certain specified limits, each of the sensors will measure their respective values and the sensor number which is then transmitted to the microcontroller. The microcontroller then broadcasts the incident-based information such as the sensor status, sensor value, and location of manhole etc. to the municipal departments through GSM modem and a GPS module. At the same time, the microcontroller time-locks the live sensor readings to an Internet of Things server thus enabling external stakeholders to monitor the drains in real time. The parameters of the sensors are graphically represented on an incorporated LCD display.

BLOCKDIAGRAM



ARDUINO UNO



Arduino Uno R3 is a microcontroller board that is based on Atmega328. It consists of 14 digital inputs/outputs pins (6 of which may be used as PWM outputs), 6 analog input pins, an internal 16 MHz crystal clock, a USB connector, power jack, ICSP header, and a reset push button. The board gets started by either connecting it via USB to a computer or a DC power adapter or a battery.

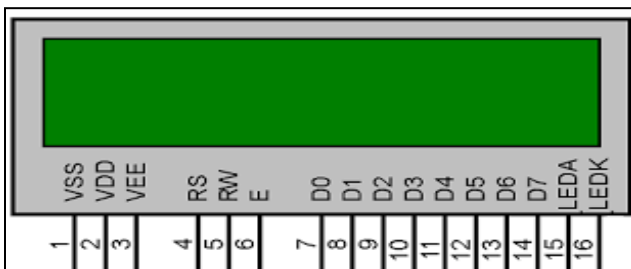
The Uno is differentiated with earlier Arduino boards in that the FTDI USB-to-serial driver chip was removed. The board itself instead uses a chip programmed as a USB-to-serial converter: the Atmega16U2 (Atmega8U2 up to version R2).

VIBRATION SENSOR:



The vibration sensor, also called the piezoelectric sensor is a mechanical-electrical transducer, which measures various physical processes by converting the mechanical vibrations into electrical voltages. It works based on piezoelectric effect where any change in acceleration, pressure, temperature, force or strain causes electrical charges to be generated. Normal sensitivities work between 10 mV/g and 100 mV/g, where the optimum sensitivity is chosen based on the expected level of vibration-amplitudes.

LCD



The said digital display is known as Liquid Crystal Display (LCD) having sixteen characters in two rows. The system transmits messages produced by it through the LCD, which is interfaced to a microcontroller. At the same time, the LCD has the functionality of an interactive user interface that is able to display real time system status information. The operation is sustained by provision of 5 VDC.

MQ135 SENSOR



With its versatile capabilities of detecting and quantifying a wide variety of volatile compounds, the MQ-135 gas sensor can be used to sense, measure ammonia, benzene, methane among other substances. The Dr. on board version of this sensor adds a Digital Pin, this enables this sensor to be used in an autonomous, stand-alone mode with no external microcontroller present. Such set up is very beneficial where it is desired to have precise monitoring of an individual gas species. When gas concentrations in parts per million are needed, the analog output must be used; this terminal point is TTL-driven and will work in a 5-V power environs making it compatible with most of the modern day microcontrollers.

CONCLUSION

The outlined system, Manhole Detection Using Arduino will be a cost-effective system that can be achieved in real-time and improve urban security and the lifecycle of underlying infrastructure. Combining several kinds of sensors, such as gas, tilt, ultrasonic sensors, the system successfully tracks dangerous gas leakage, cover movements, and other information associated with proximity. An Arduino platform based on a microcontroller allows the seamless processing and synchronization of data coming in through the sensor, and a GSM module allows sending immediate alerts to the municipal officials in the case of an abnormal situation. On site monitors aiding in the assessment of the situation by displaying real-time feedback on an LCD screen improves response time and decision-making due to availability of accurate information. Implementation of this system curtails manual checks which creates fewer risks to water service employees and also increases efficiency in its operations. It also acts as a precautionary measure to curb accidents which occur due to open or jammed manholes. Due to the clever use of the IoT concepts, the project significantly complements the goals of the smart-city development, as it enhances the development of the public safety, maintenance time-booking, and management of urban resources.

FUTURE SCOPE:

The Arduino manhole detection system can be greatly enhanced with the integration of newer technological devices with the aim of wider usage. In particular, the system could be integrated with such cloud systems and Internet of Things dashboards, thus, allowing the centralized monitoring of several manholes within a city in real-time. Also, the introduction of the method of artificial intelligence and machine learning allows not only assessing the future needs of maintenance but also performs a deeper analysis of data patterns. Solar-powered modules can be added to the system to increase energy-efficiency/sustainability. Further, GPS modules may also be used to provide accurate location details of any manhole affected. Lastly, connection to the corresponding municipal mobile apps will grant the population ability to send manhole-related remarks directly. Combined, these refinements make the system smarter, scalable, and make more alignment with the goals of wider smart-city infrastructure.

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