Sewage monitoring system based on Internet of Things

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Abstract :
This research project attempts to build an IoT technology that detects humidity, temperature levels, and gas mixtures, and senses each type of gas to measure its level, while tracking real-time dynamic changes in the above factors. If the manhole encounters a blockage and if the levels exceed the threshold, it should send an alert to the connected mobile devices of the authorized personnel located remotely at the worksite. The purpose of this research project is to monitor the measurement and analysis of the instantaneous levels of toxic gases and in order to ensure the safety of workers who work in such difficult conditions. Needs and problem solving are used. In addition to gas sensors, in this design, humidity and temperature sensors can help to evaluate the general environment of the wastewater. In order to check the blockage of the manhole, the inside of the manhole can also be viewed and checked from the camera connected to the Raspberry Pi.
Keywords: Effluentmonitoring, Effluent monitoring system, Effluent monitoring, Internetbasedmonitoring

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Interoduction

The wastewater monitoring system around the system and Internet of Things network that detects toxic gases has been developed as a measure to help healthcare workers risking their lives to reduce the health risks caused by these toxic pollutants. To be sure, the death rate of health workers has increased in the past few years. After reaching dangerous levels, the lack of proper sewage decontamination leads to the death of sewage cleaning workers due to injuries and certain diseases, including influenza and dysentery caused by sudden and long-term exposure to harmful gas. Septic pipes are structures commonly found in a variety of locations, from residential areas to predominantly industrial urban areas, that provide treatment for waste detection. Sewage gases are usually the result of the decomposition of organic wastes and compost mixtures, which lead to the accumulation of harmful wastes that release deadly gases. Alkane series, small traces of carbonic acid gas, other sulfur dioxide elements, ammonia, hydrogen sulfide, methane gas and carbon monoxide are mainly detected in septic gases. Sensors are used to measure the amount of toxic gas detected in the waste environment and give a signal. Harmful toxins emitted from waste materials such as hydrogen sulfide, alkane series, and carbon monoxide gas are detected every moment by gas sensors and corrected until reaching the normal standard. The purpose of this article is to provide an example for timely tracking, waste power plant or septic system to monitor the level of gas accumulation. The proposed system for waste, both rural and urban, will be installed in various places besides industrial plants [١],[٢].

This system can be created to shape properly in any home through small and dynamic specifications. This platform is often used over the Internet for remote monitoring of pollution levels or the identification of toxins in gases. This research also recognizes the advancement of the Internet of Things framework as its main part as installation control tools [٣].

This approach offers a complex solution for wastewater regulation compared to existing systems that ignore real-time monitoring and changes in gas concentrations and air humidity. This is because the flow of waste product water varies greatly over time and is dependent on various things such as filter quality, energy build-up and plant disruption. The above approach follows the variables that are visible every minute of evaluation through isolated areas due to electronic monitoring, which allows for accurate interpretation as well as alternative pollutants of wastewater and even emissions through gutters, and to effective monitoring and sanitation. Urban management helps [٤].

Statement and explanation of the problem:

This research plan is to measure and analyze the instantaneous levels of toxic gases. In order to ensure the safety of workers who work in such difficult conditions. This project attempts to build an IoT technology١ that detects humidity, temperature levels, and gas mixtures, and senses each type of gas to measure its level, while tracking real-time dynamic changes in the above factors [٥].

Research questions:

• What is the effect of effective monitoring and sanitization in the wastewater environment on the urban management environment.

• Identifying the humidity, temperature levels and mixture of gases in wastewater, what effect does it have on urban management.

• After pollution reaches dangerous levels, what action does the lack of proper sewage decontamination lead to?

• What are the consequences of the sudden and at the same time prolonged exposure of workers to the sewage environment with gas.

• What diseases are caused by injuries and special diseases caused by the harmfulness of the sewage environment.
• What role do the sensors play in this system?
• What are the names of the elements that are detected in septic gases?

Objectives:

The aim of this project is to try to build an Internet of Things technology١ that can detect humidity, temperature levels and gas mixtures, and sense any type of gas to measure its level while tracking actual dynamic changes in the above factors. Slow.

Theoretical foundations and research model:

• Studying research literature
• Reviews
• Choosing a design and implementation

Review of texts, background and research challenges:

Wastewater inspection framework forms were used to save the lives of workers in unsafe conditions. This is a reminder to offices that employ these workers when PPM levels of certain gases exceed designated levels. Arduino is used in polling but Arduino can't work simultaneously with tommy sensors, it won't be an effective approach. When these sensors try to provide inputs to the system's processors at the same time, complexity increases, resulting in inappropriate outputs. The device used in the survey meets the expected requirements of the wastewater monitoring system. However, it does not have any measurement facilities for humidity and temperature and live video broadcast that our prototype can overcome, so in this project it works effectively [٦].

١. Respiratory problems of sewage workers.

Examining the presence of parts of harmful waste gases with the Internet of Things. The study shows that gases such as HTS١, NSTR٢, NA٢, ٣, JCH٤, SO٥ are the primary gases present in large quantities. which leads to numerous respiratory problems in sewage workers working in primary sedimentation tanks, air screening, aeration tanks and mechanical sludge dewatering. Workers face general manifestations to acute respiratory manifestations, which include problems such as headache, dizziness, fatigue, dry cough, chest congestion, acute bronchitis, etc. [٧].

٢. Feasibility of improving the quality of treated wastewater according to soil development.

The things mentioned above are dangerous and are discussed in this article, the soil has healing properties and the pollution of waste water is significantly reduced by passing through the soil layer. Using soil as a filter for municipal wastewater treatment increases the concentration of dissolved oxygen and reduces the oxygen level of wastewater, as well as removes turbidity, soluble salts, total coliforms, and microbial coliforms. One of the problems here is that nowadays it is very difficult to maintain the proper quality of the soil. Soil is not a reliable source for reducing wastewater pollutants because it is not everywhere or even if its quality varies. In addition, large amounts of wastewater are produced every day, which requires a large amount of soil of suitable quality and human treatment. It does not address our problem of saving sewer workers from dangerous health problems. We need a reliable method to ensure that sewage workers are safe and cared for [٧].

٣. Polovino: An efficient peer-based management of IoT devices١ for air quality monitoring and cloud computing.

The proposed system tracks ground-level ozone and air pollutants that cause asthma and other respiratory diseases. Tests PPM٢ levels of pollutants, cloud-based platform manages air quality sensors [٨].

٤. Internet of Things (IoT) sewage gas monitoring and regional sewage warning system with Arduino, methane gas sensor.

This system is proposed to measure PPM levels of gases. However, their system does not take into account that temperature and humidity also play a major role in the health of sewage workers. Detection of blockage in advance is another necessity, which is not considered in this system [٩].

٥. Maintenance of sewage level using Internet of Things.

The design of the system includes a sensor that detects the level of sewage, a controller for ordering, a communication network that registers complaints about a continuous increase in the level of sewage, and in case of blockages. A database should be maintained to record the data. This system generates warning signals before overflow by notifying the specified sectors through mail and SMS [١٠].

٦. Automatic Internet of Things for underground drainage and manhole monitoring systems for big cities.

This paper describes an underground drainage and manhole monitoring system (UDSM)١ for adaptation and design features for IoT applications. The proposed model provides a framework for monitoring the water level, temperature and atmospheric pressure inside a manhole and for testing the manhole door opening. It also controls power lines installed underground. UDSM can remotely track the current status of manholes in real time [١١].

٧. Assessing integrated exposure of sewage workers to Geneva toxins: urinary biomarker approach and oxidative stress assessment.

Investigating the prevalence of various chemical pollutants and genetic poisons in sewage environments and evaluating the impact of their continuous exposure on health workers and the health of office workers. This paper attempts to effectively detect the presence of genotoxins as a result of boring tests and field trials, but does not provide a clear explanation for the observed fluctuation in HEPG١٢ cell counts in different age groups of sewage workers. It is not possible to determine how lethal such genetic toxins are for any age group [١٢].

٨. Evaluation of greenhouse gas emissions from sewage treatment plants.

Assessing greenhouse gas emissions from various municipal water treatment plants across New Delhi, and ensuring the long-term sustainability of their wastewater treatment systems. In this article, the indirect emission of greenhouse gases in the aforementioned sewage treatment plants is emphasized, but the solutions provided to eliminate them are completely unclear and ambiguous. To prevent these indirect releases, clear and effective measures are not provided [١٣].

٩. Underground drainage monitoring system using Internet of Things.

Develop and i mplement a network that regulates wastewater conditions and provides a means to maintain and control underground infrastructure using methodical approaches. The proposed model includes a wide range of complex components that require routine maintenance and observation. The current system lacks a specific network to manage different types of sensors at the same time. In such a scenario, the risk of failure is possible [١٤].

١٠. Web-based real-time underground drainage or sewage monitoring system using wireless sensor networks.

It includes a diverse network of low-cost and durable components that allow city authorities to track the sewer environment and water level at all times to ensure the safety and well-being of sewer workers. Light sensors are an effective way to ensure that manholes are always sealed and also confirm that the system and its components are intact and not vulnerable to theft. However, a disadvantage is that at night these sensors are useless without light, currently, no solution has been proposed for this [١٥].

Hardware design

Introduction

In the current proposal, we tend to use different gas sensors, including (methane sensor) and (carbon monoxide sensor) to measure any amount of toxic chemicals in the waste, as well as humidity and temperature sensors. A receiver end is given to manage the settings available at completely different node locations.[١٦] From the sewage to the control unit, the device provides a wide range of data. These sensors are set to support the concept of sensor connections to access them for commercial as well as domestic use. According to a predefined condition, the throughput is transmitted to the cloud via the GSM module٣. The project uses the framework of the key points of the Internet of Things, this pattern is applied by analyzing the drainage map and creating a field, for example. Evaluation criteria, which searches for the most suitable location. These are usually located at the starting point of the sewage. The delivery timeline can often be adjusted based on the task to be completed. For example, if operators need to understand changes in gas levels, humidity, and temperature in the sewer, they can analyze the system's planned graph on the IoT platform. In addition, blockages can be detected in advance using the live video streaming feature [١٧].

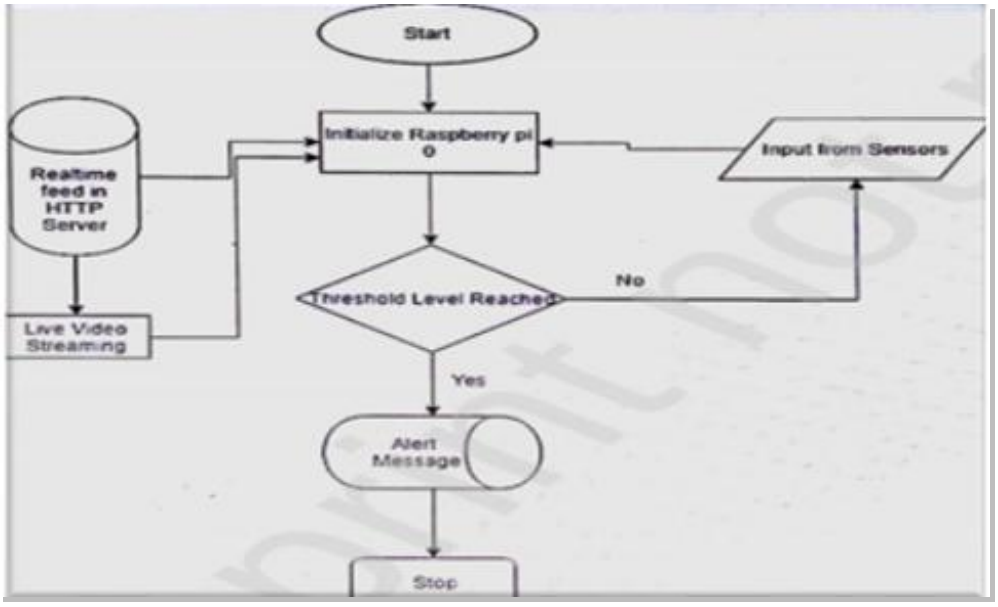

Figure١. System design flow chart

Hardware Description

The important components that make up this project

model are the Raspberry Pi and the GSM module. The Raspberry Pi helps you view sensor data such as concentration values obtained through the methane sensor (MQ-٤) and the monoxide sensor (MQ-٧) of various waste materials including sewage and moisture. and temperature sensors. In practice, with the help of the IoT platform, these ٥ ppm figures are continuously transmitted to the database in real time. Using the analytical tool, graphical representations of the ppm values of these gases are plotted.

Finally, when the readings cross the threshold based on the GSM module, a status or message is sent to the user's smartphone. The ppm sensor data rate is recorded and tracked by the consumer to avoid any accidents that may occur while working in biodegradable waste tanks and save them from diseases caused by those toxic and hazardous gases [١٧].

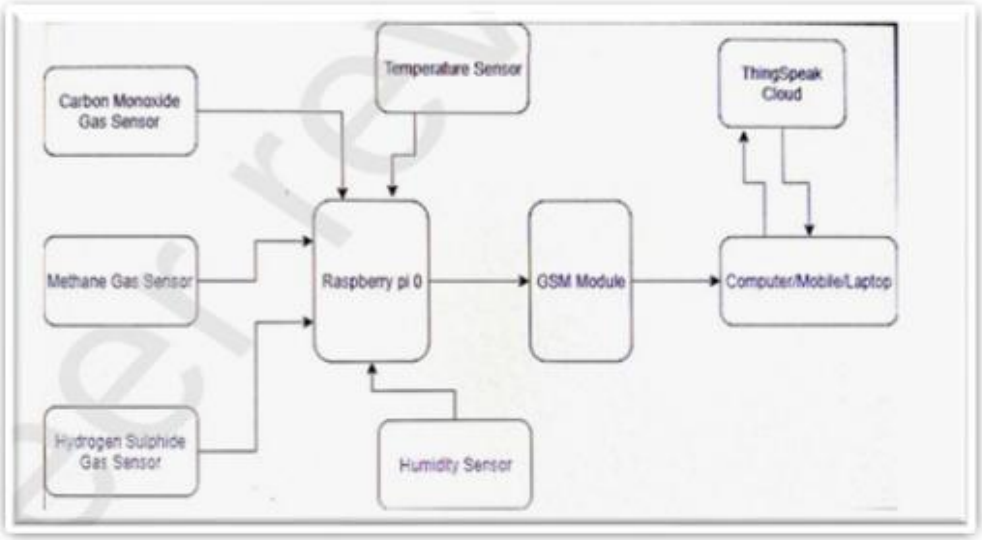

Figure ٢. Block diagram display

How to do it

Calibrating sensors

The detector should be measured indoors for a concentration of ٥٠٠٠ ppm CH and a load resistance (RL) of about ٢٠ kΩ. The sensor itself produces an analog voltage that can be converted via an ADC. The converted value may be used to obtain the expected ppm gas content for design elements. According to the IHSR EH٤, the safe humidity range for humans is between ٤٥ and ٥٥٪. While for adults, depending on gender and location, the temperature range for normal temperature is ٣٣,٢–٣٨,٢ °C (٩١,٨–١٠٠,٨ °F). Therefore, humidity and temperature sensors are designed to monitor the levels of both variables to make the wastewater environment safer for workers [١٧].

Connecting the GSM module to the Raspberry Pi.

Serial communication occurs between Raspberry Pi and GSM module. So the serial pins of Raspberry Pi (TX and RX) and GSM are used by connecting TX١ pin of GSM to RX٢ pin of Raspberry Pi and RX pin of GSM to TX. So we need to remove the RX and TX wiring once.

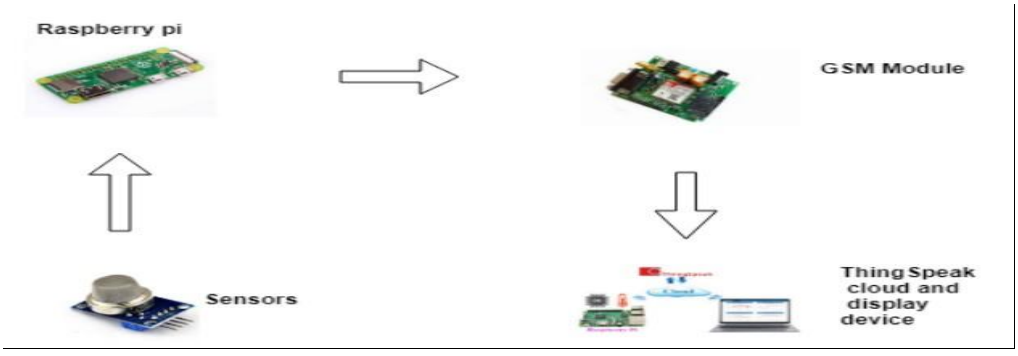

Figure ٣. Design flow

Figure ۳ shows the device architecture, which includes a Raspberry Pi microprocessor. This microprocessor implements sensor emulation, SMS generation, and software-based calling [۱۷]

Download the Raspberry Pi program

Connecting a GSM module to ThinkSpeak۱ is an IoT application that uses channels to store the data received by the devices. Data۲ A channel is created and then data is sent to and from this channel and is retrieved in the same way by changing it[۱۷] Channel configuration settings. Public knowledge sharing networks are the reset API includes the HTTP method. Camera Connection - Integrating a camera with Raspberry Pi makes it easier to detect blockages, if any, using live video streaming of the sewer interior. In addition, the proposed software-based SMS module provides users with a means to send and receive GPRS data, send and receive short message services, and make and receive voice calls. They communicate with devices such as microcontrollers, computers using AT commands, continuously. When the emergency button is pressed, the LED flashes, and a message is sent to the intended person[۱۷]

Research Project Results

Sewage in social housing and industrial facilities contributes to the natural process of producing toxic gases. When inhaled for a significant period of time, these gases can be harmful, and if high doses are absorbed into the bloodstream, they may lead to serious illnesses in the workforce. Drainage systems show the presence of gases including sulfur dioxide, methane, ammonia, nitrogen dioxide, carbon dioxide, and carbon monoxide. Therefore, these toxic gases are dangerous and sometimes lead to the death of workers, especially for sewage workers and cleaners. Hence, an IoT-based monitoring system has been introduced to prevent exposure to such workplace hazards. Previous programs suggested manual sampling for sewage gas analysis at specific intervals. Many variables such as humidity, temperature, and live video production were not taken into account. With the latest design, the shortcomings of the current system will be overcome. In addition to gas sensors, humidity and temperature sensors can help assess the overall sewage environment. While it helps sewer workers check for blockages, it's obvious that this project uses a camera connected to a Raspberry Pi to stream live video.

Hypotheses

- ✓ Effective monitoring and sanitation of the wastewater environment will significantly contribute to the health of workers in urban and rural management environments in monitoring wastewater and preventing diseases such as asthma, influenza, etc.
- ✓ Identifying moisture, temperature levels, and gas mixtures in wastewater allows for real-time monitoring of wastewater.
- ✓ Once contamination reaches dangerous levels, the lack of proper wastewater decontamination leads to worker deaths.
- ✓ Sudden, continuous, and prolonged exposure of workers to gaseous effluents can cause asthma, respiratory illnesses, including influenza and dysentery, and in some cases, death.
- ✓ Diseases such as asthma, influenza, and dysentery arise as a result of certain injuries and illnesses caused by harmful environmental factors.
- ✓ The sensors in this system have the role of sending signals and information via the Internet of Things network in real time to monitor humidity, temperature, and gases.
- ✓ Some of the elements identified in septic gases include hydrogen sulfide, alkane series, and carbon monoxide, ammonia, nitrogen dioxide, and sulfuric acid.

Method and data

Data collection

Data collection was done using the statistical population method, statistical sample, sampling and virtual space tools, validity and reliability studies, and diagnostic analysis with spatial analysis, and the present research plan was processed and written

Research tools

EndNote software for document management in Windows. Virtual space tools such as: Yahoo search engine, Google search engine, digital library. Writing tools such as: Word ۲۰۲۱ software, Acrobat Reader software

Table ۱ : Plan implementation schedule: Schedule: Specify by hatching the square

Implementation stages	Activity title	Implementation time (months)												Percentage of activity
		۱	۲	۳	٤	٥	٦	۷	۸	۹	۱۰	۱۱	۱۲	
First	Research writing	■												۱٥
Second	Research writing in accordance with regulations		■	■										۱۰
Third	Review of previous topics				■	■								۱٥
Fourth	Provision of research equipment						■	■						۱٥
Fifth	Testing research equipment							■						٥
Sixth	Testing and installing sensors and equipment								■	■				۱٥
Seventh	Testing components at the installation site										■	■		۱۰
Eighth	Testing components at the installation											■	■	۱٥

Study outputs

- Final report of the research project in one copy, along with a CD in PDF-Word formats
- Fourteen-page article report
- In addition, the results of this project will lead to the preparation and publication of articles in foreign journals and conferences, scientific-research journals and domestic conferences.

Information about the project results:

- Do the project results meet the needs of urban and rural communities that are faced with wastewater?
- Can related institutions, both governmental and non-governmental, use the project results?
- If approved and willing, the governmental or private organizations that will cooperate with this project include**:**

Table ۲: Organization Approval

Organization name	Type and level of cooperation	Responsible name and signature

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