IJARSCT
ISSN (Online) 2581-9429
International Journal of Advanced Research in Science, Communication and Technology (IJARSCT)
Volume 2, Issue 8, May 2022
Impact Factor: 6.252

Manhole Quality Management and Sensing Using IOT

Riddhi Mishra[1], Chinmay Patil[2], Sampada Kasture[3], Dipali Dhake[4]
Student, Pimpri Chinchwad College of Engineering and Research, Pune[1,2,3]
Professor, Pimpri Chinchwad College of Engineering and Research, Pune[4]

Abstract: *'A novel design of a model method of quality management of manholes in metropolitan cities that can improve the efficiency of civic bodies in an urban and technology driven country'. In these recent times, aging and outdated public sewers and underground networks and facilities have caused increased needs for systems that support the robust maintenance and management of social infrastructure. There are dire needs for measure regarding manholes involved in water, sewage, gas and electric facilities, including the supplementary countermeasures to prevent the covers from being subjected to damaged or displaced due to ill manner of maintenance, aging or torrential rainfall that exceeds its drainage capacity. There is also concern regarding covers being stolen or manholes being used in acts of terrorism, and efforts to solve the problems caused by manholes are required so that people can live in a safe environment and are not subjected to any freak accidents or unfortunate mishaps. This social concern can be monitored and solved with the integration of Internet of Things (IoT) will enable us to effectively solve the problems regarding underground network of sewers. Internet of Things (IoT) consists of real-life objects, communication devices attached to sensor networks in order to provide communication and automated actions between real world and information and data driven world.*

Keywords: Low Maintenance, Wireless Sensor Network, Smart City, etc.

I. INTRODUCTION

A smart city is the ultimate futuristic goal to achieve cleaner and better amenities for the society. Smart underground infrastructure is an important factor to be taken into account while planning a smart city. Drainage system monitoring plays a vital role in keeping the city clean and sanitary. Since manual monitoring is incompetent and impractical given that the manpower required to do so would be costing the authorities extra money, this leads to slow handling of problems in drainage and consumes more time and manpower to solve. To eliminate all these issues, the system proceeds to use a wireless sensor network (WSN), which consists an array of sensor nodes designed specifically to cater to the problem. The system discussed in this paper is that of lesser cost, conscious of manpower and caters to the convenience of the sanitation workers. It is also an IoT based real time system that notifies the relevant task force segment of civic authority with the help of text messages and alerts using a buzzing noise from a buzzer whenever there is threshold crossing anomaly detected in the underground system. This system also keeps a record of these anomalies and readings on the Cloud. This system drastically reduces the death risk of sanitation workers who manually clean the underground drainage and also in turn benefits the public safety and hygiene.

A vital piece of any seepage framework is the passages into it with regards to cleaning, clearing, and review. Metropolitan urban communities have embraced underground seepage framework and the smart city company should look after its neatness. On the off chance that the sewage upkeep isn't legitimate, ground water gets tainted causing irresistible sicknesses. Blockages in channels during rainstorm season, messes up the daily practice of general society. Subsequently there should be an authority in the city's municipality, which passes the alerts and activities taking places underneath to the authorities about changes in sewers. Temperature sensors are utilized to screen electric electrical cables that are introduced underground. The most important part of an underground drainage system is the location of their junctions and access points of the ducts that they open into when it comes

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to the inspection, quality assurance and routine cleaning. Large, well-planned cities with a sophisticated municipal corporation have an underground drainage system and it is the city's municipal corporation's duty to ensure that it is maintained and that it is clean. If there is not a proper sewage maintenance performed routinely then the ground water as well as the water table of the city gets contaminated with irreversible effects such as water borne diseases.

II. PROPOSED METHODOLOGY

The methodology encompasses quick detection and alert system using sensors and raspberry pi with help of GSM and Wi-Fi module as shown in figure.

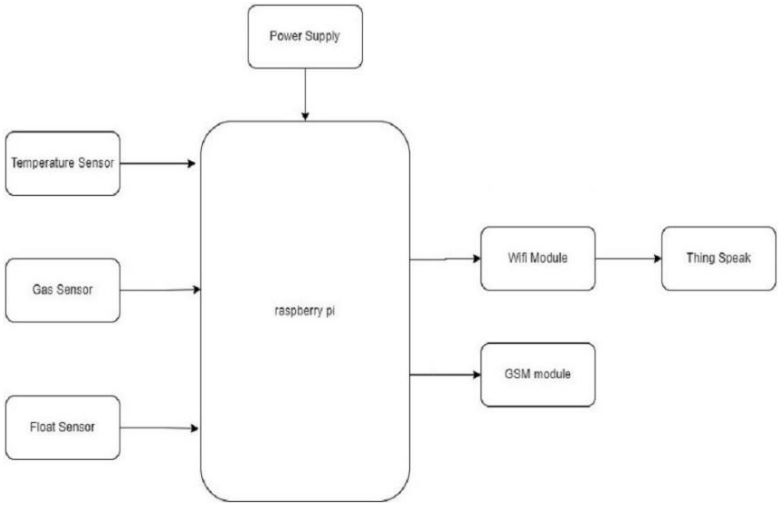

Figure 1: Block Diagram of Model

III. COMPONENTS

1. *Raspberry Pi 3:* The Raspberry Pi is an open-source, Linux based, card sized computer board, provided with GPIO pins allowing you to control electronic components for physical computing and explore the Internet of Things.
2. *Temperature Sensor:* A temperature sensor is a device used to measure temperature. Temperature sensor used here is for the gaseous state of matter.
3. *Gas Sensor:* A gas detector (MQ9) is a device that detects the presence of gases in an area, often as part of a safety system.
4. *Float Sensor:* A float sensor is a device used to detect the level of liquid within a tank. Magnetic float sensor is an electromagnetic ON/OFF switch.
5. *Wi-Fi Module:* This small module allows microcontrollers to connect to a Wi-Fi network and make simple TCP/IP connections.
6. *GSM Module:* The GSM standard originally described a digital, circuit-switched network optimized for full duplex voice telephony.
7. *Software Requirements:* Operating System: Windows 10, Programming Language: Python/C++.

IV. WORKING

This manhole is constantly under the scrutiny of three types of sensors. The temperature sensor will sense the rise in temperature. The water level sensor will sense any rise in the existing water level. The gas sensor will immediately be able to detect any presence of Carbon Monoxide or Methane. In case of any abnormalities detected by any of the sensors, raspberry pi will be notified.

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The message received by the Raspberry pi is forwarded to the assigned sim and the authority will be notified with the alert. The gist of the project working is as follows:

- The hardware is to be mounted onto the underside of a manhole lid, preferably one with a central connection or at a junction of the Underground Drainage and Sewage System (UDSS).
- The setup is a cumulation of various sensors that record reactions subject to the environmental parameters.
- The system uses the help of IoT and elaborately stores all the readings gathered on Cloud for the administrator to analyse and act upon accordingly.
- This system helps in keeping a record of activities occurring in the UDSS and introduces a factor of accountability in terms of civic body execution practices.

V. SIMULATION RESULT

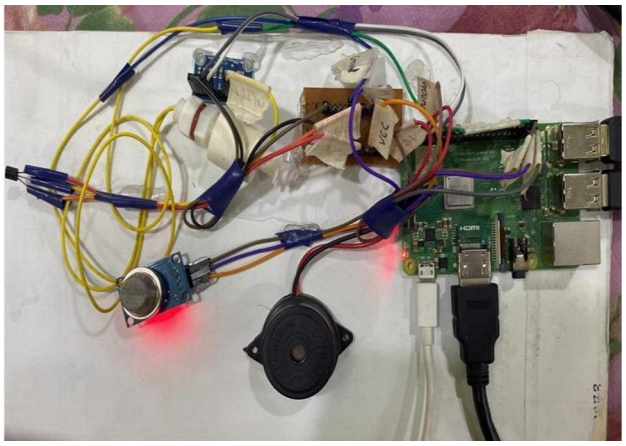

Figure 2: Working Model

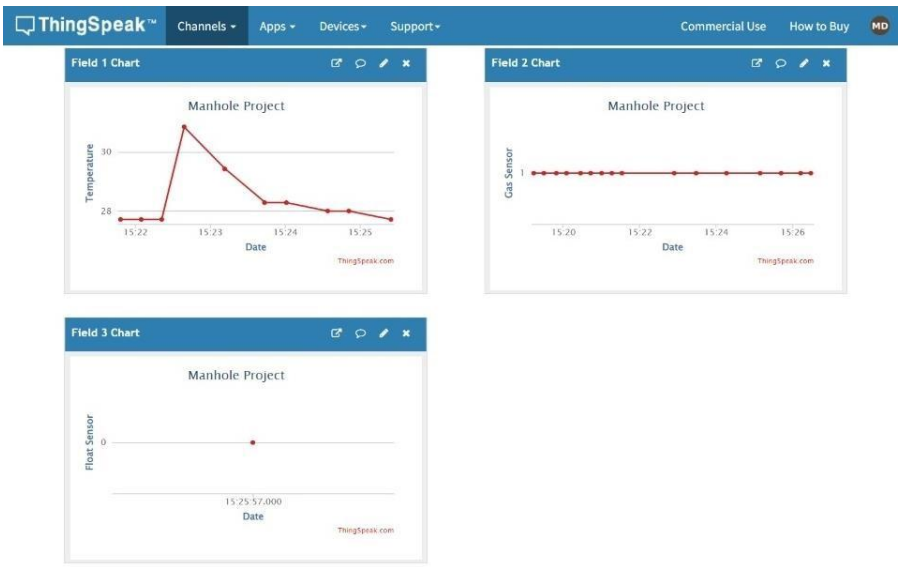

Figure 3: Data stored on Cloud

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VI. CONCLUSION

Sensor unit consequently facilitates and updates the live estimations of the actual boundaries like temperature, water level and blockages, and/or sewer vent cap is open or shut through IoT. This makes the framework keen and robust. With the help of suitable and flexible hardware, and software that keeps a check and audits the readings provided by the system, this model paves a way of co-existence between the civic management and IoT.

This model helps keep a record of the anomalies detected in the environment, and plays a keen role in possessing itself as crucial data, that will help municipal bodies practice relevant actions as required. This model ensures that a factor of accountability is introduced that will lead to an active and efficient way of civic quality management.

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