

IoT based Smart Manhole Coverage System for Urban Areas

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Article Info

Volume 83

Page Number: 2306 - 2309

Publication Issue:

March - April 2020

Abstract:

In present scenario, man-holes are the major problem in the urban areas. Most of the man-holes are in damaged condition. Because of the damaged man-holes, there are chances of occurrence of accidents in the road. These damaged man-holes will be a threat to personal safety. This paper is focused to design an effective accident avoiding system by preventing open man-holes and damaged man-holes cover. The sensors like tilt sensor, overflow sensor, Gas sensor, crack sensor and temperature sensor are used to detect the crack and the damage in the man-hole cover and then the information will be sent to the authority of the corporation department and the councilor of the area where the manhole is present. The control and the maintenance are made through Internet of Things(IoT). The Implementation of this project will be very useful to the society.

Keywords: Smart manhole cover, Sensors, IoT, Smart protection, Automated monitoring system.

Article History

Article Received: 24 July 2019

Revised: 12 September 2019

Accepted: 15 February 2020

Publication: 19 March 2020

I. INTRODUCTION

An intelligent manhole cover management system is one of the most important basic platforms in a smart city to prevent frequent manhole cover accidents. Nowadays manhole management is more important because damages in manhole cover leads to many accidents. A novel object detection algorithm is developed for automatically detecting manhole was developed[1]. It is very important to have a secure manhole management system in smart cities as the rate of accidents due to insecure manhole coverage is high. There is a chance of leakage of dangerous gases which causes explosion and even death to the persons[2]. If the manhole is not properly closed, it causes accidents. Also if there is any crack in it, the cover can be broken[3,4]. Previously the person from the corporation office has to go directly and check the man-holes or the people of that area have to inform

the Corporation Office. As everything is automated now-a-days, smart-hole manhole cover management is required[5,6]. In this paper we use various sensors to sense the damages and if any abnormality is sensed, the message can be sent to the corporation office using IoT and it can be viewed from anywhere in the world. The smart city will be definitely the most important challenges over the next few decades[7,8].

II. PROPOSED SYSTEM

The proposed system based on Arduino and it was programmed to fetch the inputs from sensors which have been connected to it and sent control signals to the external devices. The block diagram of the proposed system is shown in figure 1. The proposed system consists of tilt sensor, overflow sensor, Gas sensor, crack sensor and temperature

sensor. The sensors are connected to backside of manhole cover[9].

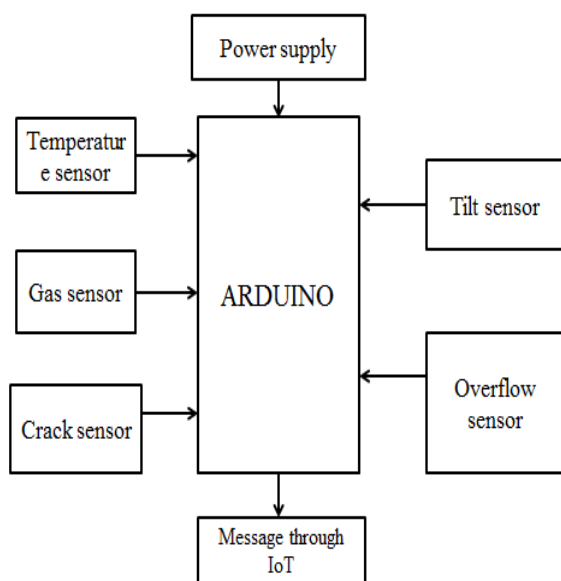


Figure.1 Block diagram

Temperature Sensor:

This sensor is used to sense the temperature inside the manhole and indicated through IoT. If the drainage water is stagnated inside the drainage, it will be identified by the temperature changes inside, by the use of Temperature sensor[10,11].

Tilt Sensor:

This sensor is used to check the angle inclination of the manhole cover to the basement. If the manhole is not properly covered or partially opened then tilt sensor will sense position of the cover.

Crack Sensor:

This sensor is used to check whether the manhole cover is broken or not. If there is any crack in manhole cover the crack sensor will sense, the condition of the manhole cover.

Gas Sensor:

This sensor is the important one because many people died due to the dangerous gases that are spread from the manhole. The Gas Sensor senses leakage and presence of toxic gases.

Overflow Sensor:

The overflow sensor is used to indicate the overflow of wastage in the drainage system. The Arduino controller fetches the sensor signals and processes the signals according to the program. The Arduino is controlled through IoT.

III. METHODOLOGY

In this proposed system, the values of multiple sensors are taken into account and a manhole cover is maintained and monitored all the time. The process flow diagram is shown in figure 2 and it involves the following steps.[12]

Step 1:

The crack sensor checks whether the crack is present or not. If yes it sends the message to the Corporation Office through IoT or else it goes for the next step.

Step 2:

The gas sensor will check the presence of toxic gas inside the manhole and if there is any leakage of gas, it informs the Corporation Office, or else it goes to the next step.

Step 3:

The temperature sensor will check the temperature inside the drainage. If there is a huge increase in temperature, it reports to the authority, or else it goes to next step.

Step 4:

Tilt sensor checks for any angle inclination. If it is 0 degree, it goes for the final step.

Step 5:

The final sensing material checks the overflow of drainage water. If yes, it informs the authority or else it continues to monitor.

Flow diagram:

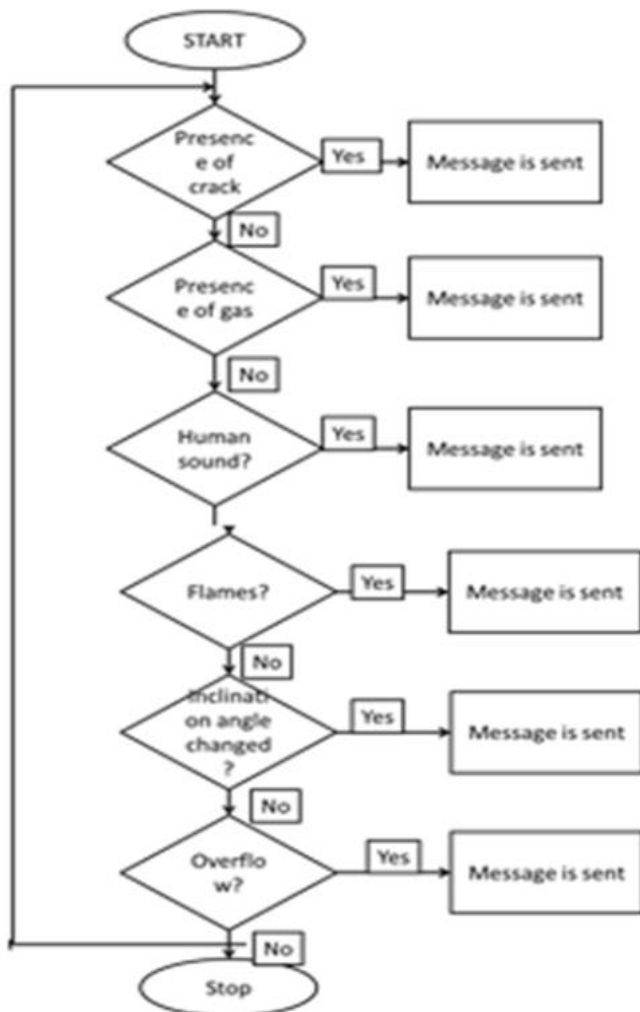


Figure.2 Flow chart

IV. IMPLEMENTATION

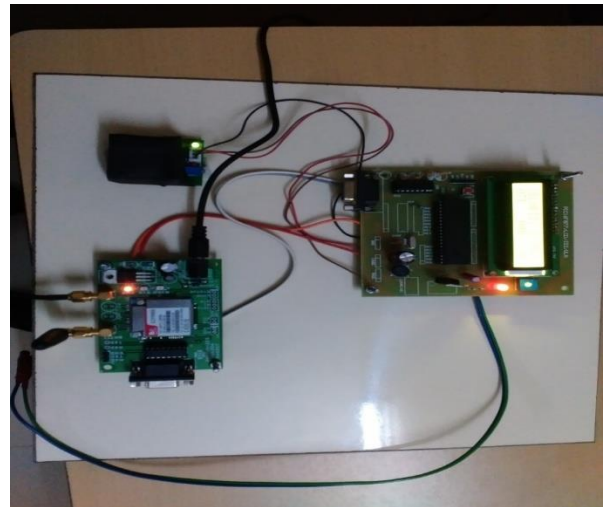


Figure. 3 Hardware view of Project

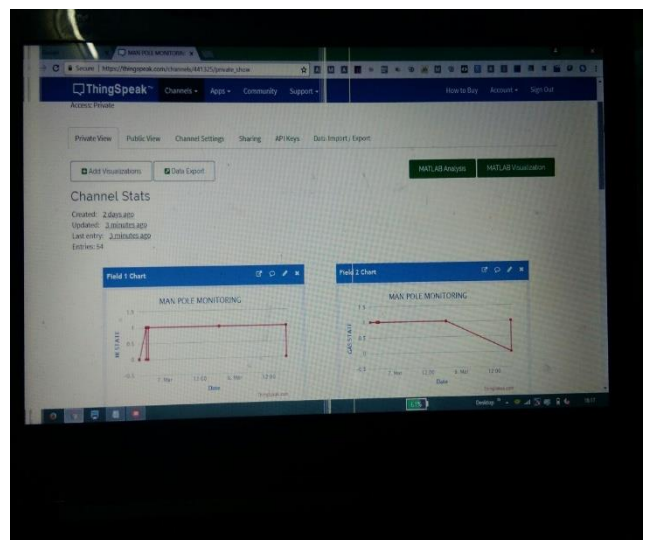


Figure.4 Software view of the project

The hardware implementation of this work is shown in figure.3. The Software view of the project is shown in figure 4. The results are uploaded in the thingspeak.com website and authorized person can view the results. So the automated monitoring of Manhole coverage and drainage system will be easier for the corporation authorities.

IV. CONCLUSION

This Smart manhole coverage system was designed by using various sensors, Arduino and Internet of Things (IoT). Most of the accidents can be reduced if the manhole coverage is maintained properly and thereby ensuring personal safety of the people. This Automated monitoring system will assist the corporation authorities for maintaining manholes and drainage system in an effective manner and it will lead to healthy environment, and also provide the way for smart city.

REFERENCES

- [1]. John R. Gallion, And Reza Zoughi, "Millimetre-Wave Imaging Of Surface-Breaking Cracks In Steel With Severe Surface Corrosion" IEEE Transactions On Instrumentation And Measurement, 2017.
- [2]. Gangyong Jia, Member, IEEE, Guangjie Han, Member, IEEE, Huanle Rao, Lei Shu, "Edge Computing-Based Intelligent Manhole Cover Management System For Smart Cities", Journal Of Latex Class Files, 2017.
- [3]. M. Chernyshev, Z. Baig, O. Bello, S. Zeadall, "Internet Of Things (Iot): Research, Simulators, And Testbeds", Iot-2488-2017.
- [4]. Jonghoon Im¹, Hiromitsu Fujii¹, Atsushi Yamashita¹ And Hajime Asama¹ "Multi-Modal Diagnostic Method For Detection Of Concrete Crack Direction Using Light-Section Method And Hammering Test 2017 14th International Conference On Ubiquitous Robots And Ambient Intelligence (Urai) June 28 - July 1, 2017 At Maison Glad Jeju, Jeju, Korea.
- [5]. Punit Rathore, Aravinda S. Rao, , Sutharshan Rajasegarar, Elena Vanz, Jayavardhana Gubbi, And Marimuthu Palaniswami, Fellow, IEEE, "Real-Time Urban Microclimate Analysis Using Internet Of Things", IEEE Internet Of Things Journal, 2017.
- [6]. Yihenew Dagne Beyene, Riku Jäntti, Olav Tirkkonen, Kalle Ruttik, Sassan Iraji, Anna Larmo, Tuomas Tirronen, And Johan Torsner, "Nb-Iot Technology Overview And Experience From Cloud-RAN Implementation", IEEE Wireless Communications • June 2017.
- [7]. Tarik Taleb, Sunny Dutta, Adlen Ksentini, Muddesar Iqbal, And Hannu Flinck, "Mobile Edge Computing Potential In Making Cities Smarter", IEEE Communications Magazine • March 2017.
- [8]. Guangjie Han, , Jiawei Shen, Li Liu, And Lei Shu, Brtco: "A Novel Boundary Recognition And Tracking Algorithm For Continuous Objects In Wireless Sensor Networks", IEEE Systems Journal 1.
- [9]. Weisong Shi, Jie Cao, Quan Zhang, Youhuizi Li And Lanyu Xu , "Edge Computing: Vision And Challenges", IEEE Internet Of Things Journal, 2016.
- [10]. Devaka Jayawardana, , Sergey Kharkovsky, Ranjith Liyanapathirana, And Xinqun Zhu, "Measurement System With Accelerometer Integrated Rfid Tag For Infrastructure Health Monitoring", IEEE Transactions On Instrumentation And Measurement, 2015.
- [11]. Shanhe Yi, Zijiang Hao, Zhengrui Qin, And Qun Li, "Fog Computing: Platform And Applications", 2015 Third IEEE Workshop On Hot Topics In Web Systems And Technologies.
- [12]. Yongtao Yu, Haiyan Guan, And Zheng Ji, "Automated Detection Of Urban Road Manhole Covers Using Mobile Laser Scanning Data", IEEE Transactions On Intelligent Transportation Systems, 2015.