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A study Based On Manhole Edge-Computing

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ABSTRACT

One of the most important basic platforms in a smart city for preventing recurrent manhole cover accidents is an intelligent manhole cover management system. Manhole cover relocation, loss and injury, which is contrary to the mission of smart cities, poses threats to personal safety. For smart cities, this paper proposes an intelligent manhole cover management system (IMCS) based on edge computing. For each manhole cover, a special radio frequency identification tag with tilt and vibration sensors is used, and for communication, a narrow-band Internet of things is adopted. Meanwhile, based on the collected information, edge computing servers communicate with corresponding management staff via mobile devices. Its high efficiency was shown by the demonstration application of the proposed IMCS in the Xiasha District of Hangzhou, China. It significantly shortened the total repair time, which could increase the protection of both individuals and manhole covers.

Keywords: *IOT, GSM, Mobile device, Power Supply, Vehicle.*

I. INTRODUCTION

A number of systems are lying underground such as electric power system, drainage system, network system and a number of holes need to be in pavement for the purpose of management. But these manholes give rise to conditions such as people and vehicles falling in holes which creates loss, displacement and damage to society thus the purpose of smart cities is violated. Accidents arising due to manholes are because of open holes which are left unmonitored in real time. Thus government officials should do periodic inspection for obtaining the status of manholes. But this will lead to consumption of a large human resource for covering the large amount of manholes covered. Also it is not able to keep real time performance. Following this strategy for inspection will consume more than a day or two or even months in suburbs. There is problem of manhole cover being stolen since there is no monitoring available. These covers are very light in weight and thus are stolen easily[1]. Thus there is a need to develop an intelligent manhole cover management system which is supposed to have the following features:

Self-perception: Every cover should be capable of self-monitoring such as when damage, tilt or displacement is there. The cover should also have the ability of self-monitoring

A. Real-time active alarm:-

It should give out an alarm whenever there is situation of tilting, damage or displacement.
Real-time response: The mechanism should give a response to the alarm in real-time and also the personnel should be scheduled.

B. Low cost of management:-

The costs of bandwidth resources, human resources and energy resources should be reduced intelligently.

C. Low repair time:-

In order to reduce probability of people falling into the bridge, the mean of repair time after any tilt, damage, or displacement should be least possible.
The features that a smart ICMS should possess are shown. For meeting these requirements, intelligent manhole cover management system (ICMS) which is based in edge-computing technology has been proposed. For monitoring itself, every cover of manhole will have a distinctive tag of radio frequency identification (RFID), vibration and tilt sensors. All manholes use narrow band IoT technology for serving the purpose of communication over the internet because of its low efficiency. The purpose of server is handling the information related to covers of manholes such as status and location values in real-time. For carrying out the purpose of schedule of repairing jobs, observing deformities concerned persons are communicated[2].
In Hangzhou, china a study was carried out and it was shown that that the time at which alarm buzzed to response of the server was not more than 15s. The system of IMCS has the ability of reducing human resources arising due to unneeded regular inspections[3]. Thus the major benefactions of paper are:
Implementing the IMCS which is an edge-computing technology so that it manages all covers of manhole efficiently with highest safety and least cost.
A narrow-based IoT approach is adopted in the suggested IMCS to serve the purpose for communication.
It has been shown that the proposed structure has a very high efficient
In Figure 1, a manhole cover is shown having a RFID tag for forming a smart cover for manhole. It has a few merits:
A few sensors are built onto it such as vibration, tilt and location sensors. This will enable in immediate sensing of any rotation, movement and vibration sensors. Thus any motion on the cover can be sensed easily and this is the most critical part.
For supplying power, a 3.6 V battery of lithium is connected and is capable of supplying power for three to five years.

The module of narrow band based IoT is built inside it. Thus all the covers of manhole are capable of communicating with the server by employment of narrow based IoT and advantages of narrow based IoT is merged with IMCS such as low consumption of power, lesser complexity in design of the transceiver, improved coverage and lesser cost of the chip. It can support connection of big number of covers of manholes in the city.

Whenever the RFID is being dismantled, a demolition alarm will send an alarm thus able to send its own report and analysis

Fig. 1 Manhole's cover with RFID

A hand-held machine is used for checking if all manhole covers are online and are normally working. This handheld machine will check all the covers periodically with period of around 5 to 15 seconds that can also be set up manually. In this paper this period has been set to 10 seconds. If any cover of manhole is found to be offline anytime, then server locates them and sends the appropriate personnel for checking. There can be many reasons for offline status of the cover such as run-out of power supplies, for this personnel will replace the batteries. Another reason can be network-problems which is stopping communication with the manhole covers, repairing of network will solve the problem.

D. Network of internet and NB – IoT

For proper implementation of the IMCS, network is the part playing the major role. It is important that the server is in proper communication with the cover of manhole. The function of managers is tracking all the covers, and server will schedule the jobs of repairing to be done by the relevant personnel. All functions mentioned are server by the network. The major requirement of communication between covers of manhole and server is the big number of connections. More than millions of manholes are there is a city, thus the network should support a big number. Also for reducing the man-power, the cover should be able to operate without any intervention from humans as long as possible. The narrow-band based IoT should be capable of supporting communicating needs from server to covers of manhole. For proper tracking the status of all covers

of manhole, both internet and LAN are used by the managers. The server of management and terminal are inter-connected by LAN in the center of management where managers can track easily the status of each and every cover of manhole by making use of LAN. For tracking status outside the center of management, internet is being used. General packet radio service and internet is used for the purpose of scheduling the jobs of repairing. The message of repair jobs is sent to the personnel through management of APP and through text messages over the phone[4].

E. Management System based on Edge Computing

By employing the two techniques discussed above, the data about the cover of the manhole can be obtained. But in case of an emergency situation, it is important that it takes the requisite action within the minimum time stipulated. If a manhole cover is being stolen, the tag of the RFID will send the information of the dynamic location to the server. The function of the management system here is to give response in real time about the location of the thief and catch it. By making a response in real-time, analysis and catching will become easier. The technique is designed for the purpose of delivering power which is elastic computing and storing at lesser cost. But this is not capable of providing a real-time response but the edge computing is capable of doing so. Thus, IMCS based on edge-computing has been proposed in the paper[5].

The necessary portions of the IMCS based in edge-computing technology is discussed below:

1. **Unique Identification :–**

   Every manhole cover needs to be given a unique identification (ID) number so that proper distinction can be carried out between them. For properly locating the defective cover of manhole, each cover should have information of latitude and longitude.

2. **Cover state of manhole :-**

   The default state of the cover should be online but it might have some other few such as rotated, tilted, offline or moved in case of any abnormal event.

3. **Mapping of location :–**

   All manholes are mapped on the city map for visualization. For the purpose of distinction, different colors are used for various states. Thus distinguishing all the defective manhole covers becomes easier.

4. **Texting:-**

   After the abnormal state is sent to the server it should notify the relevant personnel by making use of text messages. The text will contain unique ID, location information and faults for increasing the repair time[6].

II. CONCLUSION

Edge computing is a popular computing model for Enrich smart cities with tools for instantaneous computing and storage. Cloud computing is usually used in order to Provide computing and storage tools for smart devices. Inherent delays in cloud computing, however, have paved the way for The manner in which computing and storage resources are transferred From a distant, centralized position to the edge of the network. Real-time smart city technologies, on the other hand, Instant analytic services are needed. To allow for these real-time activities the use of edge computing is needed for applications. Implementing edge computing in smart cities, however, it raises important challenges. The acceptance of edge computing in this survey Smart cities are being researched comprehensively. We, to this end, first, the evolution of edge computing was discussed, addressing the incremental development of computer technology in the direction of Edge Computing Computing. Furthermore, the technology involved and the advantages of various paradigms of computing are also introduced. Second, substantial recent progress has been made. Using various evaluation criteria, a rigorous assessment is carried out.

III. REFERENCES

[1] C. G. Langton, “Computation at the edge of chaos: Phase transitions and emergent computation,” Phys. D Nonlinear Phenom., 1990, doi: 10.1016/0167-2789(90)90064-V.

[2] C. Li, X. Wu, and Y. Zheng, “Hole-edge stress field analysis on anisotropic plate with hole,” Zhongguo Jixie Gongcheng/China Mech. Eng., 2006.

[3] A. Ahmed and E. Ahmed, “A survey on mobile edge computing,” 2016, doi: 10.1109/ISCO.2016.7727082.

[4] K. Ashton, “That Internet of Things Thing,” RFID J., 2009.

[5] Kevin Asthon, “That ’ Internet of Things ’ Thing,” RFID J., 2010.

[6] P. Mach and Z. Becvar, “Mobile Edge Computing: A Survey on Architecture and Computation Offloading,” IEEE Communications Surveys and Tutorials. 2017, doi: 10.1109/COMST.2017.2682318.