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IOT BASED EARLY WARNING SYSTEM TO DETECT BLOCKAGE IN SEWER PIPELINE SYSTEM INHIGH RISE BUILDING

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Abstract **–Blockages in sewage pipelines are difficult to be identified, cleaned or extracted. In order to manage the blocks in pipelines from high rise buildings, identifying the exact location of blockages precisely is highly important. In order to avoid the sewage water drains out of the pipeline, identifying the blocks at the earlier stage of occurrence is very essential. If the blockages are not identified immediately after their occurrence, they may lead to many sufferings. Sufferings include bad odour, infections, apart from spoiling the entre day's activities. The same thing holds good in any type of high rise building. Similarly, block may occur due to the known or unknown reasons. Consequently, it becomes necessary to identify the occurrence of sewage block immediately and to alert the responsible person to attend the problem at the earliest. Thro' this paper, a novel idea to identify the block immediately after its occurrence using ultrasonic sensors and to alert the concerned maintenance in-charge at once using GSM. Moreover, the entire system is taken care by a Centralized Monitoring System based on IoT Technology.**

I. Introduction

Dealing with the drainage system is always a problem. If not dealt properly, it may develop in to a serious social, environmental problems leading to health issues. Many researchers have done their research extensively regarding this. Sewage and drain management system is one of the basic as well as essential part of social management [**SajedulTalukder et al.,"USenSewer: Ultrasonic Sensor and GSM-Arduino Based Automated Sewerage Management", International Conference on Current Trends in Computer, Electrical, Electronics and Communication, September 2017**][1]. This deals with prevention orcongestion of dirty water, rain water etc. Many thickly populated citied in our country are facing this sanitation problem and is so acute. Jian ma, in 2007, completed a detailed research in "On-line measurements of contentsinside pipes using guided ultrasonicwaves". In his research, he mainly concentrated on the industrial pipelines. He demonstrated two different techniques to over the problem.**[Jian Ma, "On-line measurements of contents inside pipes using guided ultrasonic**

waves", IMPERIAL COLLEGE LONDON, UNIVERSITY OF LONDON][2]. These researches were pointing towards industry pipelines and underground drainage system. But in big multi storied building, the real problem is the Sewage Pipelines. We understood their problem and through this study, we demonstrated a simple system which help the occupants of high rise building to avoid such problem.

In high-rise buildings, in order to drain out the waste sewage water from each residence / floor, plumbing system should function efficiently. Even after a very good plumbing system, there is a possibility of these sewage pipelines getting choked. During a discussion with a plumbing engineer, he worried about the horizontal pipelines; not about the vertical lines because the possibility of choking in these pipelines is very remote. He comments added that the possibility of chocking in horizontal pipelines from each floor is high compared to vertical pipelines. The factors which lead to chocking are many which includes human hair fall during bathing, oil substances during dish wash, more notably throwing of unwanted materials such as diapers into the sewage lines, etc., Now let us move on to the real problem scenarios. Consider the following in order to understand the seriousness of the problem.

- A sewer block happening at mid night in a Residential Flat in multistoried apartments may take away a full day from your regular schedule
- A sewer block happening at multi–specialtyHospitals

maylead to serious infections or related hazards

- A sewer block happening in a Multi-storeyed Business

Malls may collapse their business for a day or two

- A sewerblock happening in a Students'Hostel may

lead to protest / boycotting of classes which indirectly

affects thefunctioning as well as reputation of the Institution.

Let us analyse the first one in depth. A sewer block happening at mid night in a Residential Flat in multistoried apartments may take away a full day from your regular schedule. In case if a block occurs in your sewage pipeline around 11 PM in the night, you will come to know about the block only after your wake up, unless otherwise, someone disturbed by the block has to notify. Sometimes due to the block, water gets stagnated in your bathroom making the bathroom unusable. The problems what you will face:You can't use the bathroom. As a result, you and your family members can't attend nature's call. Then how is it possible for you to end your children to their schools. You need to wait for the plumber to come and set right the problem. Before that you will get yourself pressurized from all corners. This will be definitely going to take away a day from your regular schedule.Isn't it? Just to understand he importance and seriousness, we narrated the consequences. Think about such unwanted things

happening at your business place. It may collapse your business at least for a temporary period.

The main objective of the proposed system is to detect the blockage precisely in sewer system and to alert immediately the concernedauthority by sending information by using Ultra Sonic Sensors. During our study, we found many research papers leading to different ideas.

III. PROPOSED SYSTEM

Ultrasonic sensors are attached to the sewer pipelines to sense the pipeline frequently. The control unit is programmed to activate the ultrasonic transmitter transducer every 30-minute. It is integrated with IOT technology.

We integrated three- four sensors in the sewage pipeline system. Sensors are connected to the Ardunio UNO board which is embedded with SIM 900A, where the sensors are connected inside the intersection of vertical and horizontal junction of the sewage pipe. Then, power source are given from the junction board to the Ardunio UNO board which emits power to the Ultrasonic Sensors and SIM 900A. The power source and devices are shielded or locked using locking device. To prevent from the Childrens and Thieves.

If the blockage occurs in pipeline, it may leads to sewage water level rises up. Due to drain waters rise, Bad Odour occurred. It is very harmful to the resident peoples, when it enters into house. It leads to form many diseases, diarrhea, Vomiting. Due to blockage happened in the sewage pipeline which resulted overflow of drainage water. Then, it may have possible to contaminate with freshwater, which brings harmful effects to the resident peoples when consume it. It spoils the fresh water and make unfit for consumin and other commercial and household purposes.

In High-rise buildings, it may take time to clear the dirty water. To overcome from this problem, introducing an IOT based early warning system to detect the blockage at the initial stage and alert the maintenance engineer.

The blockage details include the exact location of the blockage and the width of the blockage.This can be used in future development of smart cities and housing.

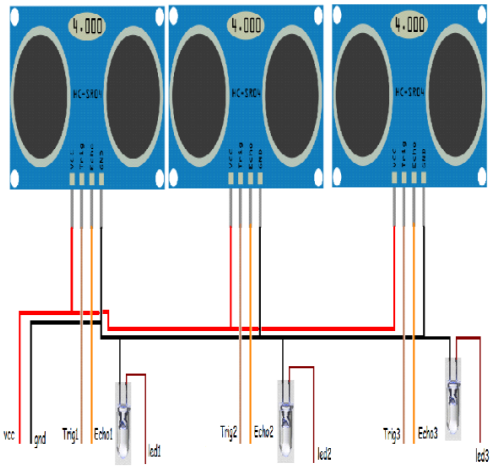

Fig 1: Schematic Diagram for integrating Multiple Sensors

IV. Algorithm for Sewage blocking system.

Algorithm to find the exact location of the block in the pipeline.

This algorithm effectively helps to find the blockage of location in the pipe. By, measuring the entire pipe distance and blocked location of the distance. After Measurement of the blocked location, by subtracting, blocked location of pipe and entire pipe length. we, finally get the exact location of the blockage in the pipe.

STEP 1.***Using Ultrasonic waves, the length of the pipe is measured and is kept as a Standard Reference***.

STEP 2.***Using this Standard Reference – Distance (D), the time taken by the Ultrasonic waves totravel and return is calculated and s noted down as Standard Reference – Time (T).***

STEP 3.***Ultrasonic waves shall be generated at regular intervals (say an hour or 30minutes)***.

STEP 4.***Velocity or Speed of the wave =distance travelled / time.***

= twice * the length of the pipe / time

= 2 l /t where l=length, t = time

Now, l = Velocity or Speed of the wave * t / 2.

STEP 5.***Check l = D_{SR}. If both are equal, no block***.

STEP 6.***If l<D_{SR}, possibility of block and issue a warning.***

From the algorithm 1, it can be understood that on the first instance of Ultrasonic pulse release, the total length of the pipe will be measured. Keeping that one as Standard Reference with respect to Distance, further release of Ultrasonic pulses, at regular intervals, can be used to monitor the occurrence of block. In case of a block occurred, Ultrasonic pulse transmitted will get returned at a smaller duration of time. This will be compared with the Standard Reference. If the value is less than the Standard Reference, then a block in the particular pipeline is confirmed.

Algorithm 2:

Algorithm to send alert message thro' SMS to remote users.

The Ultrasonic transducers in the pipe, are integrated with INTEL Ardunio UNO and connected with SIM 900a. The following procedure will be used to alert the resident thro' GSM module.

STEP 1.***Get the concern person's mobile number.***
STEP 2. ***Set Exact Baud rate (9600) of the GSM/GPRS Module***
STEP 3. ***Read the baud rate when blockage happens in the pipe.***

STEP 4. ***Write the message by using the command***
"AT+CMGF=1\r"
Where *'r' is the message, which sends to the concern person.*
STEP 5. ***Set the mobile number in the command using***
AT+CMGS=\"+ZZXXXXXXXXX\"\r".
STEP6. ***Replace XXXXXXXXX to 10 digit mobile***
number & ZZ to 2 digit country code
"AT+CMGS=\"+ZZXXXXXXXXX\"\r".
STEP 7. ***Stop.***

V. SYSTEM ARCHITECTURE

The multiple sensor units are interconnected to the Arduino UNO board or Galileo kit which is already programmed using the arduino IDE. The Arduino UNO boards is connected to the SIM900 a or connected to the Ethernet shied to transmit the data as well as sending the alert message to the concern authority. The sensor units are programmed to trigger the ultrasonic waves every 30 minutes to sense the pipeline. Multiple sensors are integrated and fixed different locations of the pipe. Then Arduniouno board are connected to SIM 900A for the purpose of alerting a user and send the exact location of block happened in the pipe.

When the sensor units sense any blockage it is redirected to sense the pipeline every 5 minutes. If the block is sensed at the same location for at least 3 times, it will send the alert message to the concern authority using the SIM 900a module or the Ethernet shield. The remote users are the concern authority and the people living in that residence.

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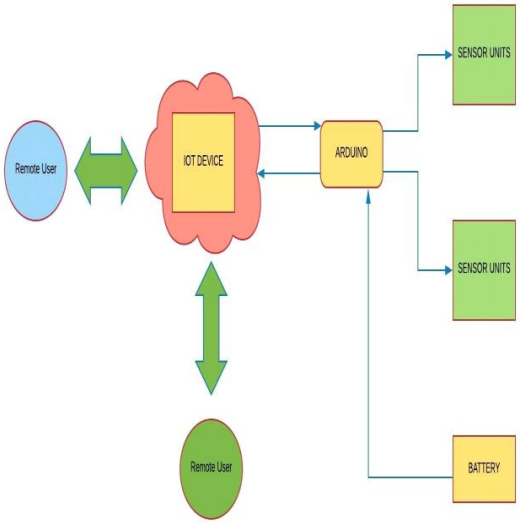

VI. CONCLUSION

In this research initiative, many sensors are integrated at different locations of the pipe in High Rise buildings. If a blockage happens in any of the pipes, using the sensor, the distance of location of the block in that particular pipeline can be measured and using the GSM module, the alert message will be sent to the concerned authority. Locations are identified by using the algorithm, that we know the length of the entire pipe. After blockage happens in the pipe, it shows the distance of the blocked path. By subtracting the Entire

length of the pipe to the blockage location of path, which have a distance from the sensor. Using tis, we can calculate the distance regarding the exact location of block.

VII. FUTURE ENHANCEMENT

In future work, we plan to implement, An IOT based early warning system to detect blockages in sewage system using ultrasonic sensors with extension to Smart city and house .

VIII. ACKNOWLEDGMENT

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