INTELLIGENT BASED SEWAGE BLOCK DETECTION AND CLEARANCE SYSTEM USING IOT

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Abstract-Sewage blockages are quite common at present in small as well as big cities worldwide. This has become alarming due to the use of polythene bags and other solid materials which are dumped into the sewer system. The sewage lines get frequently choked leading to their blockage and overflow which results in sanitation problems and creates health hazard for citizens and labours. When manpower involved in clearing the block, it leads to fatal due to hazardous gases present in it. In this project, to overcome the issue of hiring Man power into the manhole to remove the blockage, we introduce an intelligent clearance system using IoT. This system consists of level sensor, Arduino, RF transceiver, gas sensors, relay, valve, LCD and Bluetooth. Level sensor detects the level flow in the sewage system and we can detect the block by flow of water and Gas sensor is used to detect the hazardous gas in sewage system which leads to fatal. Once the sensor crosses its threshold value it gives alert to concerned authority through mobile. Once the block is detected, the alert is received and highly concentrated liquid is given through the valve which is driven by relay to clear the block without using man power. This system has economic impact and will be useful to environment and sewage workers.

Keywords: Internet Of Things, Level Sensor, Gas Sensor, Blockage Detection, Sewage Monitoring, Real Time Application.

1   Introduction

Sewage system plays a major role particularly, especially in large cities. The world is rapidly becoming smart cities, but the problems encountered are still those of the primitives. The modern world is in great need of modern advances and sophistication in its planning. There is no proper monitoring of the sewage system at houses. The sewage system has instability and uncertainty with the characteristics of the variable and nonlinear variant of thetime and the random processing process.

Sewage systems are generally networks which convey waste water, solid wastes, rain water from the environmentthrough the series of underground pipes and manholes. Finally, it is retreated or returned to the environment. A sewage gas is a combination of toxic and non-toxic gases which accumulate in the different zone of the sewage system depending on the wastes. Sewage gas is generated during the decay of household and industrial wastes.

Highly toxic components of sewage system include hydrogen sulphide, ammonia and Nitrous oxide. Sewage gasesalso contains methane, carbon dioxide, sulphur dioxide and nitrous oxides. In addition, bleaching powder, industrial wastes and gasoline frequently are present in municipal and privately owned-sewage treatment systems.Sewage gases are taken in to major consideration because of its terrific features such as odour, health issues, potential for creating unhygienic environment. Retno Tri Wahyuni states that a practical implementation of a low-cost Wireless Sensor Network (WSN) is done by using Zigbee communication and acoustic sensor

technologies to monitor the water level of the sewage. A Zigbee based WSN was selected for this implementation due to its attractive features such as low data rate, low power consumption, simple communication infrastructure. There aretwo ways of using a sonic transmission to detect the water level, i.e. (i) by measuring the time of flight from transmitter to receiver – it will be faster in water, (ii) by using the level of the received signal [1].Several risks and health issues arises because of exposure of sewage gases which includes hydrogen sulphide poisoning, Asphyxiation, tuberculosis, ulcer etc. Hydrogen sulphide at low concentration (150ppm) may leads to loss of consciousness and causes death. Chandler Kemp states that Drainage is the system or process by which water, sewage or other liquids are drained from a place and to maintain the proper function of drainage, its condition should be monitored regularly. But manually it is very difficult to monitor all area where a human cannot reach [2].

High concentration of methane will decrease the presence of oxygen in air. The scarcity of oxygen causes severalabnormalities such as head ache, nausea and giddiness. When oxygen concentration is less than 12% then death may occur suddenly. In addition to above features specific sewage gases such as Hydrogen sulphide and methane holds explosive property. Gaurang Sonwane represents the application and design function of a smart and real- time Drainage and Manhole Monitoring System with the help of Internet of Things [3]. J.kathirvelan designed a predictive disaster and alert generation system using WSN to provide information and early alerts and used various gas sensor to detect gases and the system will able to monitor all these things in real-time scenario whichwill allow us to take proper actions of the particular problem in drainage system [4].

In most of the countries there are various protective measures are taken to prevent the mortal rate of sewage workers such as providing safety suits and respiratory probes to the person entering in to the manhole but in India sewage workers uses spliced bamboo sticks to remove the block. Dr.Seema Verma et al represents the sensor nodewhich is deployed where a human cannot reach to monitor and collect the data, so the operation of the sensor nodedepends on inbuilt battery. More energy is consumed in transceiver than that of processing. So Minimizing the Energy consumption is a key challenge in Wireless Sensor Network [6]. The sudden blast of such block exposed with sewage gases which will affect the functioning of brain as soon as possible. Apart from the sewage workersthere are the persons called divers who swim along the pipe line to remove the blockages. This process may take up to 50 hours. Nearly 225 sanitation workers are died in last five to six years. Around 2100 children under the age of five died in India particularly 1800 children are died because of poor sanitation and hygiene in the Environment. Due to such an unfriendly and harsh environment direct sewer inspection and maintenance operations are life threatening.

2   Methodology

In this project, to overcome the issue of difficulties in monitoring sewage and hiring man power into the manholeto remove the blockage, we introduce an intelligent based monitoring and clearance system using IoT. This system consist of level sensor, Arduino, relay, relay driver, gas sensors, LCD and Bluetooth modem. This systemregularly monitors the water flow level and hazardous gases present in it. If the gas sensor has crossed its thresholdvalue, it will send alert message through GSM module, so the workers will not enter the manhole. Once the blockis detected, the alert is received and by using high concentrated chemical solution, which is sent through the valvewhich is fitted in sewage pipe to dissolve the block. Hence the fatal rate can be avoided. This is fully automated distributed system for block detection and Sensors are addressed, thus localization identification of block is made simple. The block is removed by using chemical dissolvent. Monitoring the sewage system from fixed place is done through IoT. This system has economic impact and will be useful to environment and sewage workers.

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3   Modelling and Analysis

SINK NODE:
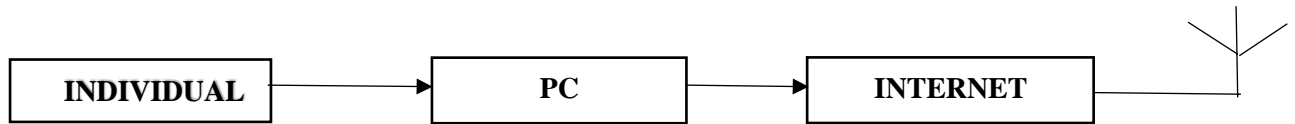
FIXED NODE:
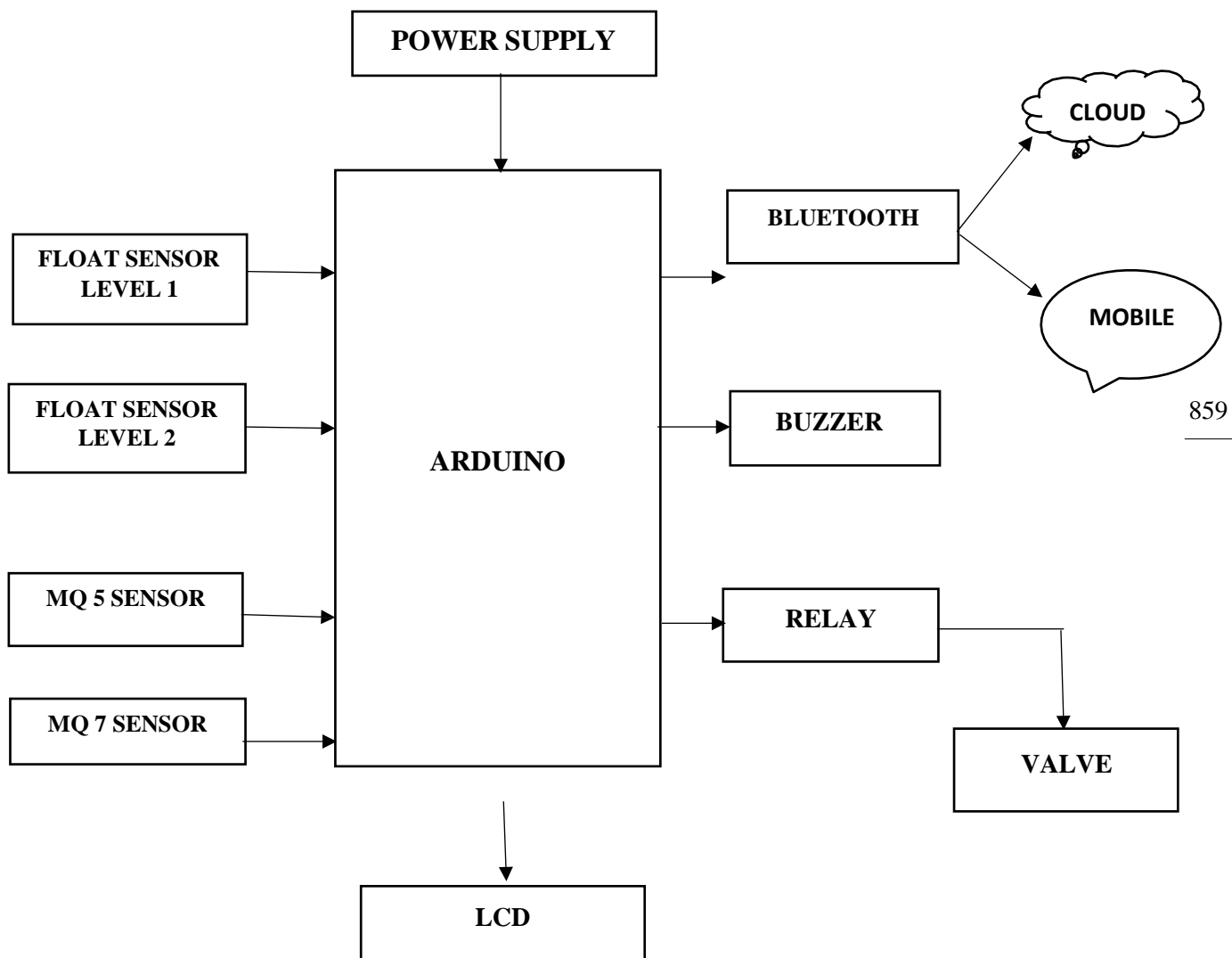
Figure 1: Block diagram of Intelligent Sewage Block detection and Clearance System

ARDUINO: Arduino UNO 328 has 14 digital input and output pins and 6 analog input pins.It receives the sensed data from particular sensors and processed here and it sends the information to the mobile node and cloud. The Arduino UNO 328 is coded in C language.

LEVEL SENSOR: Float-type sensors can be designed so that a shield protects the float itself from turbulence and wave motion. Float sensors operate well in a variety of liquids, including corrosives and detects the flow level in those conditions.

GAS SENSOR: Gas sensors are available in wide specifications depending on the sensitivity levels, type of gas to be sensed, physical dimensions and numerous other factors. This Insight covers a methane gas sensor that can sense gases such as ammonia which might get produced from methane.

STEP DOWN TRANSFORMER: When AC is applied to the primary winding of the power transformer it can either be stepped down or up depending on the value of DC needed. In our circuit the transformer of 230v/15-0-15v is used to perform the step-down operation where a 230V AC appears as 15V AC across the secondary winding. The next alteration will temporarily cause the reverse. The current rating of the transformer used in our project is 2A. Apart from stepping down AC voltages, it gives isolation between the power source and power supply circuitries.

LCD: It is used to display the gas detected and level of the water in sewage system. High-resolution color displays such as modern LCD use matrix structure.

VALVE: A solenoid valve is an electromechanically operated valve. The valve is controlled through solenoid by electric current. in the case of a two-port valve the flow is switched. Solenoid valves are used as control elementsin fluidics.

This system consists of two nodes one is Fixed node and the another one is Sink node. The fixed node consist of water level sensors which is used to detect the level flow of sewage water by using it we can detect the blockage in the system. Gas sensors are used to detect the hazardous gases in the sewage system such as methane, propane, hexane, hydrogen sulphide, sulphur di- oxide. The sensed data is processed in Arduino and further the information is sent to the concerned authority's phone through message and stored in cloud. The sink node consist of PC connected with internet and monitored by an individual. The aim of this node is to monitor the sewage system regularly for further analysis. If the sensor has crossed its threshold value the alert is sent and buzzer is ON and the block is cleared by high concentrated solution.

4 Results and Discussion

The system is assembled successfully and the output has been displayed in the LCD Screen as well as.

Figure 2: Hardware module.

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Figure 3: LCD Display

The hardware module is completed with reference block diagram (Fig:1) and Hardware testing is conducted (Fig:2), the hazardous gases detected in the sewage system and the increased level of water flow which indicates the blockage in the sewage system is displayed in LCD (Fig:3) and the alert is shown in the sink node(Fig:4)which will be monitored regularly by concern department. The location of the blockage and the indication of alert is also sent to the Municipal cooperation or to the concern authority's mobile number through message (Fig:5).The results has been achieved successfully. The module has been checked with both hardware and software testing tools. Hence this system will be a Real Time application to the society for providing better enhancement for sewage system.

Figure 4: Cloud for sewage Monitoring

Figure 5: Screenshot of message sent to the concern mobile number

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5   Conclusion

The project "**INTELLIGENT SEWAGE SYSTEM BLOCK DETECTION AND CLEARANCE SYSTEM USING IoT**" has been completed successfully and from the outcome of this project, work for future development can be enhanced. This system provides an efficient way to detect the block. This prototype addresses about smart and real-time drainage monitoring system to decrease the mortality rate of sewage workers due to hazardous gases from sewage. Sensor is the networks which are considered as the key for the IoT. By doing this, we can able to take particular action on the problems, as we will receive the early alerts of blockage as well as increasein level of flow. This project is having enough avenues for future enhancement. In future this project can be implemented with **wi-fi technology** which will be linked with cloud to save the results and to give the report for further analysis. We took a Step forward in the field of **"ADVANCED AUTOMATION"** and this willfurther pave a road path towards faster development in the same field.

6   References

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