

SMART SEWERAGE MONITORING SYSTEM

Dr. M. Usha Rani¹, Mallineni.Jyoshna², B.P.Kruthika³, D.Pavithra⁴, Kondapalli.Kedareeswari⁵

¹Assistant professor, Department Of Electronics And Communication Engineering, Velammal Engineering College, Surapet, Chennai, Tamil Nadu, India.

²⁻⁵B.E-E.C.E, Velammal Engineering College, Surapet, Chennai, Tamil nadu.

Abstract: This paper presents the issues on one of the major problems in urban areas and that being, overflow of sewers. Several manholes across residential areas are overloaded due to excess sewage load. This inefficient gully pot network is the major reason for the over flooding of mainstream sewage pipes as well. Thus, there is a need for an efficient system design for monitoring a gully pot which is capable of providing required information about sewage block prior to the occurrence. Such system would require detection of the flow within the gully pot and for the communication of this detail, we use a Wireless Sensor Network (WSN). The mechanism of message transfer through this network can be established via a local area network (LAN) devices such as zigbee, IoT or LoRa.

Keywords: smart sewerage monitoring system, LoRa (long range) , WSN (wireless sensor network) , innovative system.

Introduction

The successful functioning and development of any society involves keeping the road and streets, safe and clean.

In order for this to happen the gully pot network on that road and throughout that area must be constantly monitored for leakage and other such problems. Gully pots can be defined as the centralized collection or storage point for the sewage coming from nearby household from which it goes into the mainstream. Efficient design is required for Gully pot monitoring system which is capable of providing sufficient information about the sewage water level and Ph of the sewage and also to identify the presence of toxic gases produced in the gully pot to avoid human casualties. More often than not, manual scavengers are the ones who get into these gully pots and work irrespective of the inhumane conditions. In order to end this dehumanizing act, we propose then use of wireless sensory network.

Wireless sensor network is used to gather information regarding real time events that has to be processed, stored and saved for future use. The gathered information is transferred to main sewer using sensor node. This wireless sensory network is used for intelligence monitoring of temperature, humidity, water level, presence, vehicular activity, remote health

monitoring of several patients. The rural and suburban environment causes less distortion in wireless communication networks than in the urban areas. Wireless sensor network in this paper is especially being deployed in sewers for sewage monitoring, it's over flooding and also to monitor methane and other such hazardous gases. This acts as a major data requirement during floods and other disaster in the government's disaster relief strategy. In earlier days gully pot monitoring was done using CCTV. However, CCTV is an expensive and an unviable method and data interpretation from this could only be done manually. This problem was overcome by using WSN technique.

Depending on the level of technological advance, there are a number of options through which the WSN can be implemented. These include, as stated earlier, IoT (Internet of Technology), ZigBee and LoRa. Considering the various aspects and parameters of the above stated technologies, LoRa seems to be a more viable option for the implementation of the Sewerage monitoring system. LoRa WAN is a low power wide area network technology (LP-WAN) designed for Internet of Things (IoT) and smart sensor applications. As the name implies, long range transmission capability with less power consumption makes LoRa a significant player in IoT network.

In LoRa technology, a message transmitted by any device can be received by single or multiple gateways. The received messages will be forwarded to the central network for processing. Smart server architecture will handle these messages to each related applications.

LoRa alliance is an open, non-profit organization of members that standardize, develop, monitors and improves LoRa standard. Internet of Things is one of the major drivers behind this highly efficient LP-WAN technology.

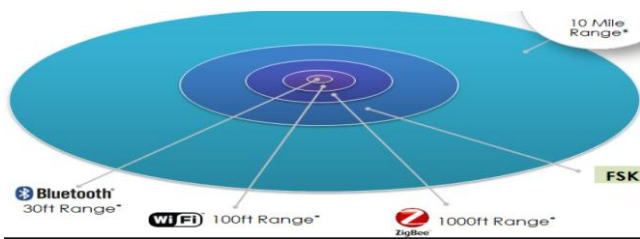


Fig: 1 LoRa providing long range access and compatible with other WSN technologies.

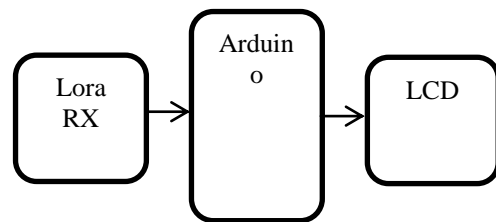


Fig:2 Block diagram at node 2

Methods

The Existing methodologies in most developing and underdeveloped countries include, manual scavenging, which is a dehumanizing act or visual inspection which is very inefficient and costly. On the other hand, many water companies have deployed telemetry systems to replace some of the manual operations. These include, multiple sensors to be placed and used to measure and collect data in numerous locations. This data is then used by various software and application programs that allow the data to be turned into useful and accessible information. This however proved to be of major disadvantage because the Telemetry system's running costs remained expensive as these systems require extensive cabling for PSTN (public switch Telephone network) and power cannot be deployed over a large catchment area because of the cost.

The modern/Proposed method includes the following:

A practical implementation of a low cost wireless, WSN using LoRa communication and acoustic sensor technologies to monitor the water level of the Gullies in residential urban area. This monitoring system helps avoid congestions on road due to sewage blocks and improves the public health as well as increases sanitation of a society.

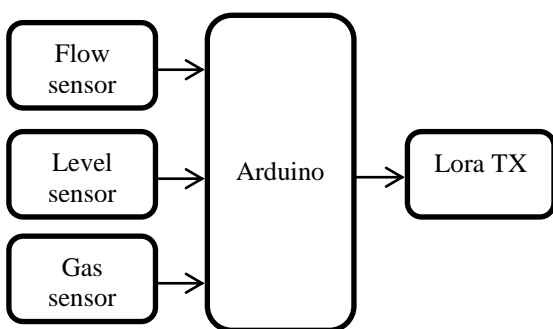


Fig: Block diagram at node 1

Working:

Wireless sensor network is used to gather information regarding real time events. The actual measuring is done by sensors. The three sensors we use are level, flow and gas sensors. A probe type water level sensor is used and it works on the principle of single point probe sensor. The sensor will have dielectric constants. They measure changes in the value of capacitance when the sensor is dipped into the liquid. The change corresponds to Level variation. Similarly, the gas sensor placed in the toxic or combustible gases environment, reacts with the adsorbed oxygen particles and breaks the chemical bond between oxygen and free electrons thus releasing the free electrons. As the free electrons are back to its initial position they can now conduct current, this conduction will be proportional the amount of free electrons available in SnO₂, if the gas is highly toxic more free electrons will be available. The water flow sensor consists of a plastic valve from which water can pass. A water rotor along with a Hall Effect sensor is present to sense and measure the water flow. When water flows through the valve it rotates the rotor. By this, the change can be observed in the speed of the motor. This change is calculated as output as a pulse signal by the Hall Effect sensor. Thus, the rate of flow of water can be measured. The pins of the sensors are connected to the respective Arduino pins which read the analog inputs and transfer it onto the LoRa module.

In LoRa technology, a message transmitted by any device can be received by single or multiple gateways. The received messages will be forwarded to the central network for processing. Smart server architecture will handle these messages to each related applications.

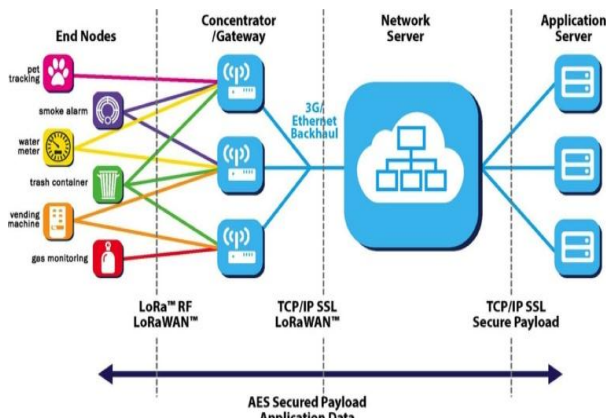


Fig: 3 Working of LoRa

The main principles of the innovation of the system include:

- 1) the increase in the rate of danger that is caused due to the scavenging and the ways of sewerage monitoring;
- 2) the main reason for the floods that occurred in India was because there was no proper sewerage management resulting in the loss of many lives and also loss of wealth ;
- 3) the proper sewerage management will not only be useful to know the exact situation of the working of the sewerage monitoring system but and to be prepared for whatever the output might be ;
- 4) the innovation in these systems is hence required to get the detailed report on what the situation of the sewages will be;
- 5) the neat and clean environment is also the main aim and to maintain this there must be a good management of the sewages and this is also an another reason so as to innovate the present systems;

Development problems	Solution options
1. Lack of skills in the competitive struggle	Educate the staff in accordance with the specific development objectives
2. Reduction of using man power	Avoid using man power and instead implementing new different technologies that will be much useful and helpful
3. Necessity to improve the management system	The General Manager must work in a team. Prepare the reserve management. Prepare the energetic managers

5. Lack of a common vision and common goals	Elaborate a mechanism for strategic development of innovation activity within the whole structure of the sewage monitoring systems
6. Lack of mechanism for idea propagation	Establish the creative teams to generate new ideas. Ensure the mode constant search for ideas and interest in creation of the new ones. Establish a permanent expert groups on improvement the management systems. Ensure the conditions for the creative work of the staff
7. Ineffectiveness of the management	Strengthen the management group so that there will be proper working of the entire system without any imperfections
8. Lack of effective motivation of the employees innovators	Implement the internal risk insurance of the employees innovators against possible failures. Register the order and stages of acceptance, evaluation and implementation of ideas. Raise the moral and material incentives for the innovators. Improve the quality of information exchange "bottom-top", eliminate any misunderstanding and rejection of new ideas by the individual managers. Use the potential of the individual managers. Establish a system of personnel management. Develop the corporate culture
9. Inconsistency of the operational services, narrow specialization, uncertainty of a problem as a whole	Establish a system of delegation of authorities and responsibility at all levels of management
10. Lack of system in the development of new services	Provide proper way to reach the authorities such that they will help in reaching the people to inform prior to any damage

Results

Based on the results that are conducted for the proper sewerage management system we will be able to conclude the conditions of the gully pot. The monitored system will be able to send the messages that will directly reach to the higher associates and the further action will be taken by them in order to warn the people prior to any damage occurred.

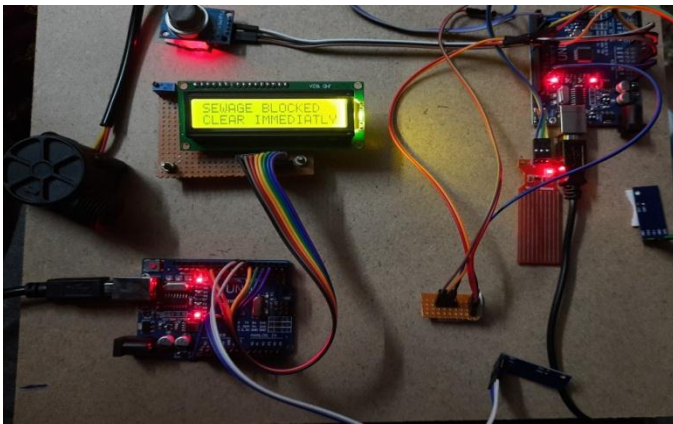


FIG 4: LED display at the receiver end

The other results that will be taken from the setup that will reach to the both higher associates and the people in order to save from any nuisance occurring and therefore the other results will be included in the software and that will be as shown In the below figures.

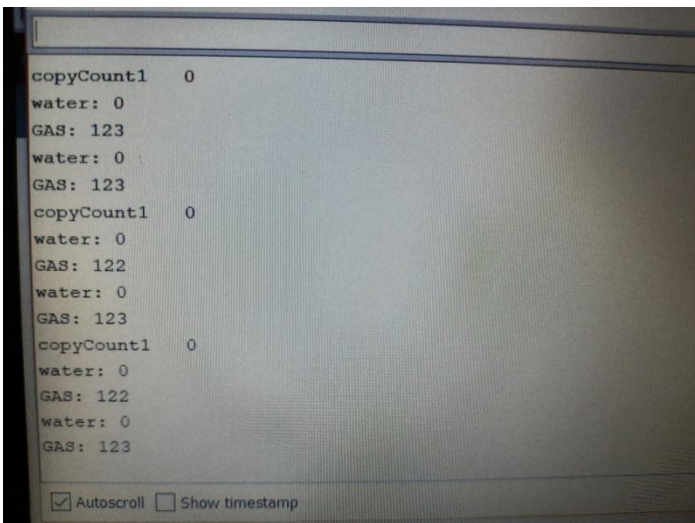


Fig: 2.the output for the monitoring values

Discussion

Based on the results that will be conducted such that there will be an accurate knowledge of the entire sewage systems and the authorities will be able to help the public through managing and handling the entire setup that is much more helpful in all cases and preventive steps can be taken in order to be much more careful.

Conclusion

There are a lot of dangers that occur due to man scavenging of the sewage systems. In order to avoid these kind of situations it is better to employ the smart sewage monitoring systems. By using this system we can ensure

that there is no harm done to the humans. This system also consist of the LoRa which is used for the long range transmission of the data. By employing these smart sewage monitoring systems we could also change the ways of monitoring the sewage systems in to a better one.

References

- [1]OFWAT, "Service and Delivery- performance of the Water Companies in England and Wales 2007-08 Report",http://www.ofwat.gov.uk/regulating/reporting/rpt_lo2007-08.pdf
- [2] Cauligi S. Raghavendra, Krishna M. Sivalingam, and TaiebZnati, "Wireless Sensor Networks", Springer-Verlag New York Inc.; Sep 2006.
- [3] D. Geer, "User make a Beeline for ZigBee sensor Technology," Computer, vol. 33, pp. 16-19, Dec.2005.
- [4] H.-C. Huang, Y.-M.Huang, and J.-W. Ding, "An Implementation of Battery-aware Wireless Sensor Network Using ZigBee for Multimedia Service," InternationalConference on Consumer Electronics (ICCE '06) Digest ofTechnical Papers, pp. 369-370, Jan. 2006.
- [5] C.Evans-Pughe, "Bzzzzzz [ZigBee Wireless Standard]," IEE Review, vol. 49, pp. 28-31, March 2003.
- [6] Crossbow, Inc., Mica2 wireless module, <http://www.xbow.com/Products/productdetails.aspx?sid=174>
- [7] A.Tolstoy, K.V.Horoshenkov and MT Bin Ali, "Detecting pipe changes via acoustic matched field processing", Applied Acoustics, Vol.70, May 2009, pp.695-702
- [8] Energy efficient gully pot monitoring using RFID R.A.Abd-Alhameed et al (2013), proposed the concept of RFID technique to monitor the gully pot. An RFID system comprises of RFID tag, reader, software and database.
- [9] An integrated sensor network to enhance the performance of gully pot monitoring Karthik saran M et al (2017), discussed the concept of better processing of sewage and to avoid flooding risk during heavy rain in metropolitan areas.
- [10]Automation of smart waste management using IoT to support Swachh Bharat Abhiyan- practical approach Bharadwaj B et al (2017), developed the concept to collect the dry and wet waste separately, which is to be placed in conveyor belt.
- [11] IoT based smart waste management system Akshay Bhalerao et al (2018), proposed the concept where the ultrasonic sensors are used to sense the water level if the level of sewage rises. It records the threshold value and sends the notification to the sewer using Wi-Fi module.