Drainage Overflow Monitoring System using IoT (DOMS)

R. Girisrinivaas [1],
UG scholar, Department of CSE, Saveetha School of Engineering, Saveetha University, Chennai, Tamil Nadu, India,
girividhur@gmail.com.

V. Parthipan [2],
Assistant Professor, Department of CSE, Saveetha School of Engineering, Saveetha University, Chennai, Tamil Nadu, India
parthipan@saveeth.com.

***Abstract*— In India the sewage system is one of the major issues, due to the poor maintenance of the sewage system the sewage water is overflowed on the streets and sometimes mixes in the drinking water which damages the health conditions of the people, to overcome this issue we are proposing the model called Drainage Overflow Monitoring System (DOMS). This proposed system will monitor the water level and gas level in the sewage system and the measured values will be stored in the cloud storage then analysed and the sewage system condition will be sent to near the corporation office as SMS using GSM module.**

***Keywords*— GSM module, Environment monitoring, DOMS, SMS, ultrasonic sensor, gas sensors, tilt sensor.**

I. INTRODUCTION

In India most of the cities has underground drainage system and the sewage system is maintained by Municipal Corporation to make the environment clean and healthy. Sometimes due to poor maintenance of the drainage system, the water in the drainage system gets mixed up with the pure water and infectious diseases may spread on the environment. Due to variations in the climate during different seasons the drainage gets blocked andmakes the environment unhealthy and makes the people upset and distribute the routine life. To overcome all the issues in the drainage system and inform the municipal corporation about the condition of the drainage system by sending sms through GSM, so that the officials can take the necessary action to repair the drainage system.Even the gas formed inside the drainage system due to bio wastage also detected using the gas sensor so that we can avoid explosion due to pressure inside the drainage system. If the drainage system lid is opened for long hours using tilt sensor we can detect the opening of the lid and inform the municipal corporation officials to take action on it. So our main aim of this idea is to monitor the drainage system using the sensor. If the sewage system gets blocked or water overflows or if the drainage lid is opened it is monitored using the sensor and the sensed information are sent to the nearby municipal corporation official via SMS using the GSM shield and the water overflow and gas value are stored in the cloud storage for the later analysis purpose.

II. SYSTEM ARCHITECTURE OF PROPOSED

Fig. 1 shows the system architecture of the proposed WSN, the network consists of GSM [5] sensors nodes, network coordinator, and Cloud storage. In order to examine the information and analysis results, a remotegraphical user interface is developed further. Based on the proposed system architecture, sensor nodes response to sample the physical parameter to measurable voltage level through corresponding sensors; then GSM module digitalizes and codes the voltage level to network information; sent these acquired data to the organizer through the established wireless links. Coordinator is focusing to constellation maintenance, collect data and transfer the reassemble information to the cloud storage using the GSM transceiver through mobile internet. Open WSN Cloud data storage platform Xively [6] custom-made in this work. The Xively platform offers versatile data assortment and visual image; therefore ease the support of enormous number of sensor data streams and processing.

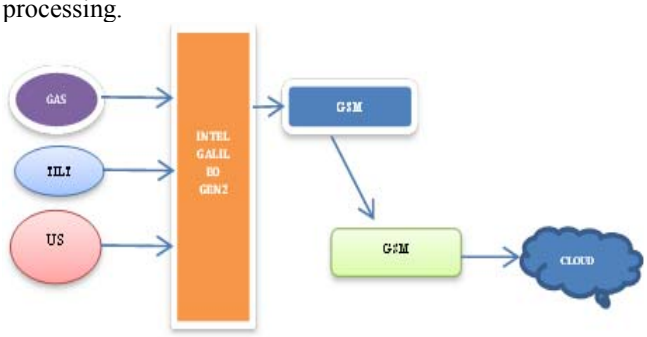

Fig. 1 Proposed System Architecture

A. *GAS SENSOR*

A gas detector is a device that detects the presence of gas in a region, usually as a part of a safety system. This typeof equipment is used to notice a gas leak or other emissions and might interface with a control system so a method is automatically shut down. A gas detector will sound associate alarm to operators in the area where the leak is occurring, giving them the chance to depart. This kind of device is very

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important because there are several gases which will be harmful to organic life, like humans or animals.

Gas detectors are usedto detect flammable, burn able and healthful gases, and oxygen depletion. This kind of device is used wide in the industry and might be found in the locations, like an oil rings is used wide in industry and might be found in locations, like on oil rigs, to observe manufacture processes. And it's used to observe the gas formed in the drainage system.

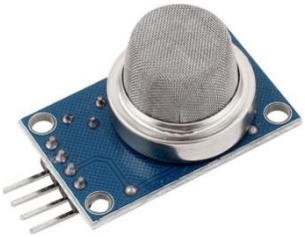

Fig 2: Gas Sensor

B. *ULTRASONIC SENSOR*

An ultrasonic detector is a device which will measure the distance to an object by using sound waves. It measures distance by causing out a sound wave at a particular frequency and listening for that sound wave to recover. By recording the time period between the sound wave begin generated and therefore the sound bounces back it's possible to calculate the distance between the echo sounder sensor and the object. Using this detector the water level is detected.

Fig 3: Ultrasonic Sensor

C. TILT SENSOR

The tilt sensor is used to measure the tilting in two axes of a reference plane in two axes. One way to measure tilt angle with reference to the earth's ground plane, is to use an accelerometer. Typical applications can be found in the industry and in game controllers. It is used to find whether the drainage system lid is open or not

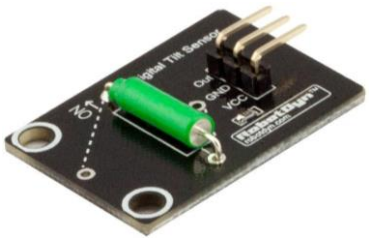

Fig 4: Tilt Sensor

D. GSM

If you're in Europe or Asia and employing a movable, then likely you're mistreatment GSM technology in your movable. GSM stands for world System for Mobile Communication. it's a digital cellular technology used for transmission mobile voice and information services. The conception of GSM emerged from a cell-based mobile radio system at Bell Laboratories within the early Nineteen Seventies. GSM is that the name of a standardization group established in 1982 to form a standard European mobile phone standard.

GSM makes use of narrowband Time Division Multiple Access (TDMA) technique for transmission signals. GSM was developed mistreatment digital technology. it's a capability to hold sixty four kbps to a hundred and twenty Mbps of knowledge rates.

GSM provides basic to advanced voice and information services together with roaming service. Roaming is that the ability to use your GSM telephone number in another GSM network.

A GSM network contains of the many purposeful units. These functions and interfaces are explained during this chapter. The GSM network may be broadly speaking divided into:

- The Mobile Station (MS)
- The Base Station Subsystem (BSS)
- The Network Switching Subsystem (NSS)
- The Operation Support Subsystem (OSS)

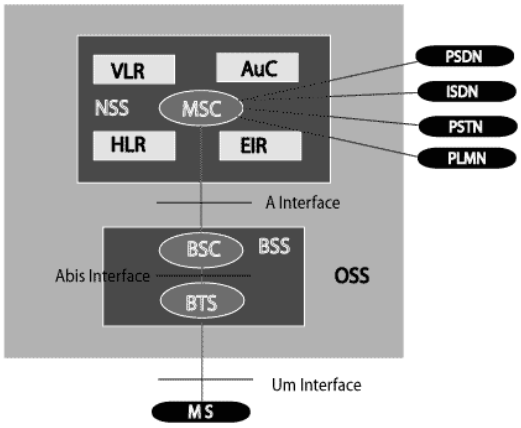

Fig 5:GSM Architecture

III. EXPERIMENTAL SETUP

A. PERFORMANCE EVALUATION

As mentioned within the introductory section, the WSN during this project aims to observe the surface water drainage throughout rainfall as application. Relied on the vary measure of the ultrasonic sensor, the water level is logged and monitor continuously during a wide geographic area. To verify the performance of the proposed WSN, an experiment was setup as shown in Fig. 6.

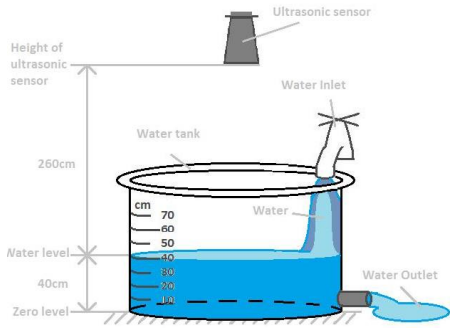

Fig. 6 Experimental Setup

In Fig. 6, a storage tank with water outlet is used to simulate surface, then adjustable water flow is feed into the tank through inlet with valve. The sensor node in previous section was mounted 3 m on top of the tank and 0 levelswere calibrated. Therefore once tank is filled with certain level of water, the ultrasonic sensor will observe the vary difference and determine the associated water level.

Based on the on top of setup, storage tank was filled with 20 cm water level at first, throughout the experiment; water was feed into the tank (initial feed rate is 634.90 ml/s) whereas water was drained thought the outlet at the same time for 50 minutes (initial drained rate is 347.80 ml/s).The sensor nodes readings are reported to the WSN organiser and recorded in the Cloud storage wirelessly through the GSM WSN and WCDMA mobile internet. The collected data as measured water level are plotted in Fig. 7. In this figure the water level within the tank is logged and monitored. It shows this figure, the water level within the tank is logged and monitored. It shows the general water level between 0.2 m to 0.4 m. By control the flow-in water quantity in several time instances, the water level was increasing, maintained and decreasing at different time; these can beobserved in the points A, B and C in Fig. 4 respectively. However, in this figure, the overall water level was increasing in general.

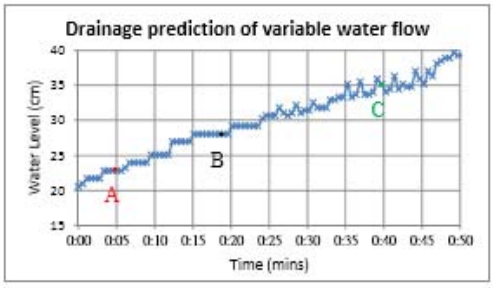

Fig. 7 Measured Water Level of the Experiment

Besides the water level work, the proposed WSN helps the flood prediction based on the received water level data and its tendency. For an easy approach prediction at purpose A as an example, based on the previous 5 minutes water level data taken, the water level increasing rate is determined based on the derivative, such the predict water level are increased to 26 cm and 40 cm in coming 5 to 30 minutes severally. The proposed WSN, prediction accuracy is improved with intelligent data analysis algorithms and strategies.

Fig. 8 GSM SMS

The water level and the gas level in the drainage setup will be messaged if the level of the water and level of the gas get increased via GSM as an SMS to the nearby municipal corporation office as shown in the fig8.

IV. CONCLUSION

A GSM WSN is proposed and developed for surface drainage detection using ultrasonic sensors. As an application, it is applied for the rainfall monitor and flood prediction under the rainfall scenario. Based on the experiment verification,

correct water level is detected and recorded. Basic approaches based on the consecutive data are applied for easy flood detection. On the other hand, intelligent processing technique is applied on the proposed WSN indeed.

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