



A Smart Culvert Monitoring System Using IOT Based Technology for Global Applications

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Abstract. Surveillance of Sewage is a crucial element in ensuring the sanitation and welfare of towns and villages. Currently, accidents involving to shattered and absent claddings are relatively prevalent. Manhole covers are really not checked effectively in poor nations. Such mistakes may cause significant damages as well as death, personnel supervision remained poor and resulting in managing issues inadequately. Following researching such issues, we developed a IOT based surveillance system that monitors temperatures, toxins and water density. In order to completely observe the drain cover and avert such incidents, we also incorporated a number of different sensors. A tilt detector is initiated to show out whether culvert could really tilt. The whole paper contains a gas protection to supervise its gas emission out from drainage facilities such that harmful effects can really be surveilled. The inbuilt heat is indeed supervised unless a confirmation is made. Additionally, a float detector is utilised to notify whenever the liquid level exceeds a particular level. If any warning is generated based on variables, we use the SIM800I GSM to dispatch an SMS towards the appropriate authorities.

Keywords. Monitoring of Drainage, Internet of Things, Tilt Sensor, Float Sensor, SIM800I GSM Module.

1 Introduction

The [1] [2] article describes an Internet of Things-based culverts system that keeps temperature, gases, and water level. The majority of the culverts are open and about any hazards. Community safety is at risk because of these damaged culverts. Therefore, through rescuing, our scientific study helps to prevent accidents.

Here [3] [4] the detector continuously records the gas concentration and lids open status, and indeed the collected information are sent to another At mega 328p IC [6] [7]. The analyzed data could transmit to the hosting stations through the use of the LORA system allowing lengthy transmission and saved in cloud through post treatment [8] [9].

A device called Integrated solar Culvert Monitoring Technique was presented in By keeping an eye upon that gases within the culvert, the suggested SMMS

equipment will warn the municipal government through a cloud platform when a problem is detected [10] [11].

In order to manipulate the unprocessed signals, the system uses an Embedded system, sensing applications with ultrasonic sensors [12] [13]. Sending alarm messages to such officials or people utilises the GSM Network as well. When transmitted and sent to cloud, every data collected will take the shape of a plot. ESP 8266 is going to record the files in the database and on the central server [14,15 & 16].

IOT-based smart sewage, servicing hole surveillance, and gas surveillance cameras are provided by the software product SPYDRAIN [17]. Using only a smartphone app, this should convey the accurate position to notify the company's employees to seal the sewer.

In explains the creation of such a system that utilizes deep learning algorithms, which could also reduce significant expenses associated with successfully environmental surveillance and lead to a positive, healthier now. With either a NN that recurrently (RNN), specifically condensed version remembrance, it was evolved (LSTM).

In discovering a blockage in the sewage system caused by silt. This requires employing an acoustical device to follow the widths of something like the tube until the wastewater touched and utilizing a camera to capture a snapshot of each of the particular wastewater throughout in order to distinguish it because of obscurity inside a sewer.

In presents two dielectric substrate transmitter designs that may be installed towards the bottom of conventional metals culverts and function at 920 MHz for something like a limited large-scale network having decreased danger of impact damage.

In develops a thin strip IOT based automated culvert management solution. The software part, internet protocol & application server make up the overall system. Data about culverts is gathered via the sensor surface, which is centered on an integrated ARM computer and uses embedded sensors.

A unique method that employs specialized sensor components &transmits the data as a microchip to continually monitor hazardous sewage gases, sewage positions, and lid layers. The suggested system uses IOT technology and includes a sms alerting feature and a permanent alarm .

In accomplishes tasks including data transmission, recording alarm records, executive function, password management, surveillance cameras, and precise placement by sending the well cover looks alarms info tracking terminals through GPRS networking with radio frequency technologies.

Comprehensive survey method on the waterproofing membrane (MC) problems, providing a thorough categorization and evaluation for these bases of parameters upon that effect towards planet, as well as the continuous monitoring methods that are used. Additionally, it assesses how automatic and manual monitoring techniques are used, as well as how the nature of subterranean affects the MC architecture..

3 Related Work

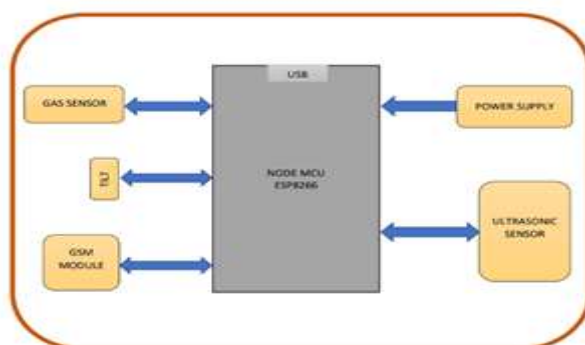


Fig. 1. Proposed Circuit diagram interfacing with NODEMCU

Basic Components Utilised:

A. NODE MCU:

There are fully accessible development circuit designs for the Node-MCU open-source electronics. Node MCU is a combination of the terms "node" as well as "MCU". In actuality, the firmware instead of the related development kits is what is meant by "Node-MCU" in this context. These designs for the prototypes boards their firmware are indeed open source. A computer chip acting as a double in-line product that incorporates a USB microcontroller with a tiny ground board holding the MCU as well as transmitter is the experimental hardware that is frequently utilised.



Fig. 2. Node MCU architecture

B. SIM800L GSM Module:



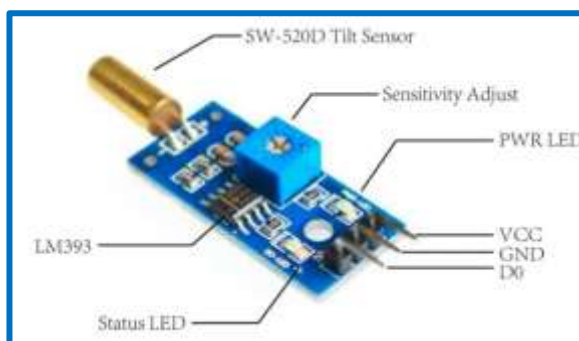
Fig. 3. GSM SIM800L module architecture

The SIM800L is indeed a tiny cellular device that supports GPRS communication, SMS send or receive and phone calls generating and accepting. Such

module is the ideal choice for any task that necessitates long distance networking because of its low cost, compact size, support for four bands of frequencies, and relatively inexpensive. The power module starts up after being connected, looks for a mobile network, and logs in quickly. LEDs on circuit show the throughout the . Every module

two first is and solders the NET PCB. it is use in spaces. a PCB that is coaxial and also an

using double-sided tapes. Here it performed best and enables customers to house your device within a metal frame, provided the transmitter is outdoors.



comes with antennae. The formed of wire immediately to pin on the excellent for confined The second is transmitter coupled with connection IPX adapter

C. MQ Gas Sensor:

A class of detectors known as MQ gas sensing is used to identify a range of gases, including ethanol, smoking, methanol, Liquid petroleum gas, hydrocarbons, Nitrous oxide, benzene, and propylene. These associated with the work of an electrode that has a sensing substance placed on top and is warmed to increase its reactivity and sensitivity. Gas detectors come in a broad range of dimensions , sensing technologies, and ranges.

Fig. 4. MQ Gas detector

D. SW-520D Tilt Sensor:



Fig. 5. Tilt architecture

A tool planar is a tilt detector. come in many varieties, their purpose is the are designed to whenever a



sensor

used to detect displacement Despite they different fundamental same. They recognise planes

transitions from straight to perpendicular and to provide a notification when that occurs. There seem to be modules that can detect very tiny planar shifts, however in this article we'll talk about than a straightforward interaction inclination detector. In this case, we'll be using the SW-520D Angular position sensors component.

E. Ultra Sonic Sensor -A86 JSN-SR04T:

Fig. 6. Ultrasonic sensor

Ultrasonic detectors at inexpensive prices are widely accessible in India. The issue with any of those instruments is that they generally appropriate for use in manufacturing environments in which there is a substantial amount of dust but also where water damage is also a possibility. The JSN-SR04T ultrasonic level sensor plays an important role in this situation. Such device is ideal for actual uses within industrial and business enterprises, not merely in the laboratory for any research.

4 Proposed Methodology

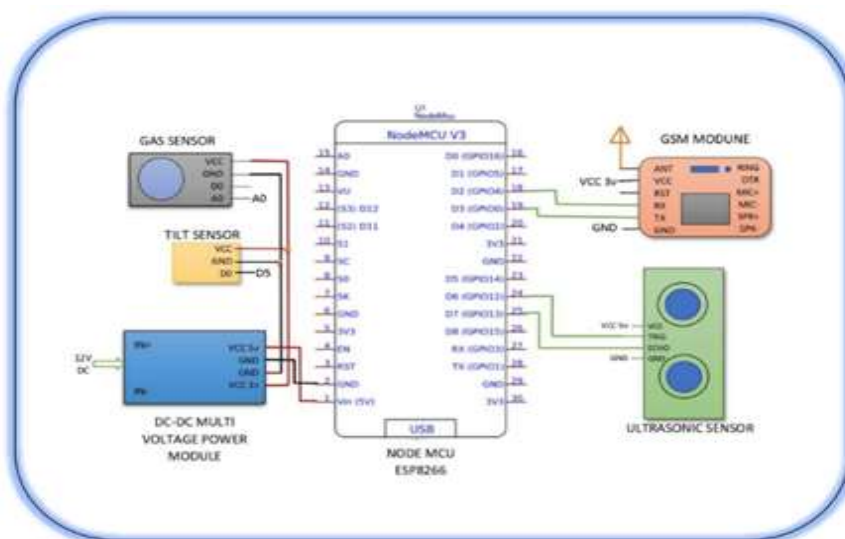


Fig.7. Proposed connecting diagram with Node MCU

Here 3 sensors—a sensing element, an accelerometer sensor, and a tilt detector with a SIM800L GPS receiver and a Constant current multivoltage energy module have been used. To provide output voltages of approximately 3.3V, 5V and 12V a Constant current multiple voltage electrical converter is used. To find out if there is gas present, a detector is employed. The water level is detected using a sensor module, and indeed the inclination of the manhole cover is determined using a tilt sensor. Ultimately, SMS messages concerning these events are sent using a SIM800L GSM, Modem.

5 Experimentation and Results



Fig.8. Proposed Experimental setup

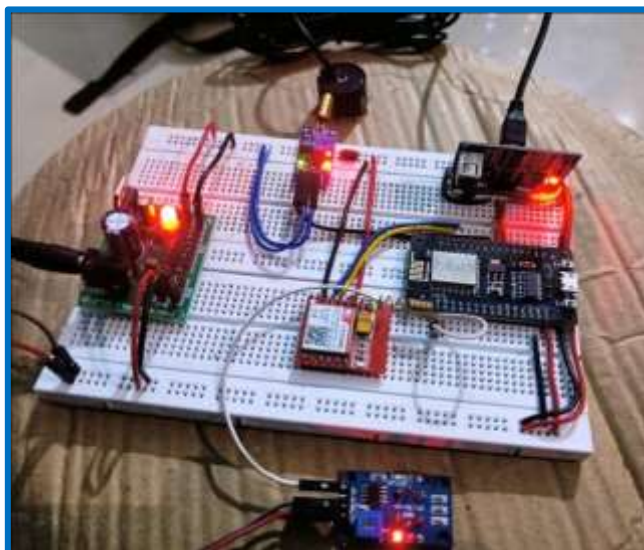


Fig.9. Proposed onboard setup with sensors

Case 1: When Gas Detected



Fig.10. Gas detection through GSM module

Case 2: When water level exceeds its limit



Fig.11. Water level detection through GSM module**Case 3:**When man hole cover opened**Fig.12.** Manhole tilt detection through GSM module

Components	Specifications
Node-MCU	Operating voltage – 3.3V Input voltage – 4.5 to 10V Flash Memory/SRAM – 4MB/64kB Digital I/O pins - 11
SIM800L GSM Module	Input voltage – 3.8 to 4.2V Operating voltage – 4V
MQ-2 Gas Sensor	Operating voltage – 5V Analog Output Voltage – 0 to 5V Digital Output Voltage – 0 to 5V
Tilt Sensor	Power Supply – Up to 24V Switching Current - <5mA
Water Proof Ultra Sonic Sensor	Operating Voltage – 5V Operating Current – 30mA
DC-DC Multi Voltage Power Module	Input Voltage – 6V to 12V DC Outputs – 3.3V, 5V, 12V

Table 1.Components Specifications

6 Conclusion

Numerous people affected by negligent sewage maintenance have been reported in recent times. Therefore, by implementing various multiple sensors, users may use these device setups to recognize various aspects including the availability of gasses, an elevation in water level and sometimes even whether or not sewage has been opened. SR-04T waterproof detector is suited for sewer liquid level measurement that identifies the existence of obstructions, SW520D tilt sensor will sense the raising and shutting of sewer head while MQ gas detector sensor suitable for identifying different noxious gas mixes. The Node MCU collects various detector outputs and processes them accordingly. In response to the issue, Node MCU communicates a signal to such SIM800L type GSM Module, which serves as the primary communicative component while Node MCU simultaneously moves the information to the surveillance display. If we desire to expand this version in the long term we could update it along with modern sensing devices and add a digital thermometer as well since the temperature inside the sewer was also relatively high and it may lead to a problem. As a result we could also stop it.

7 References

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