



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 10, Issue 10, October 2021

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 7.569



Smart Safety Monitoring System for Sewage Workers using Arduino

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ABSTRACT: This paper aims to measure and analyze the real time levels of toxic gases, in order to ensure safety of the workers working in the sewage. This project attempts to sense toxic gases and the measure its level. If levels exceed beyond threshold, it shall send an alert to the relay to actuate oxygen cylinder. If any blockage is encountered, it can be monitored. Most of the cities adopted the underground drainage system and it's the duty of Municipal Corporation to maintain cleanliness healthy and safety of cities. If the drainage system is not properly managed then pure water gets contaminate with drainage water and infectious diseases may get spread. Drainage cleaning people are not aware of risk by sudden attack of poisonous gas since the gases are odorless if exposed for long time which may cause serious health problems. Due to the lack of using proper gas leakage detection system, a number of dangerous accidents occurred during the last few decades. To overcome all these problems effective monitoring system is needed in the drainage channels. The detected system is proposed with gas sensors like Carbon Monoxide, Hydrogen sulphide sensors and Methane, one Heart Beat sensor used to calculate the pulse rate of Human. Carbon Monoxide, Hydrogen sulphide, Methane gases are highly toxic to human hence the proposed system will give alert through the LCD Display after reaching the threshold level of each gas sensors then people gets alerts. Heart Beat sensor will calculate the range of the Pulse rate then output at the abnormal range will give alert through notification through an IOT.

KEYWORDS: Automation, Smart Safety, Arduino

I. INTRODUCTION

Effluent around the arduino system and network that detect toxic gases has been developed as a measure to help sanitation staffs who risks their life to ensure reduced health hazards due to these toxic contaminants, sanitation employees' death rates have increased over the past few years. After reaching hazardous levels, the lack of proper sewage decontaminating results in the deaths of sewage cleaning staff from injuries and Specific illnesses including influenza and dysentery caused by abrupt yet prolonged harmful gas exposure. Septic pipes are structures commonly found in a variety of locations, ranging from housing areas to mostly industrialized urban areas, providing treatment for waste material diagnosis. Sewage gases are usually the result of decomposition of organic waste products and mixtures of compost that result in assembly of noxious waste which releases lethal gases. Alkane series, small traces of carbonic acid gas, other sulfur dioxide elements, ammonia, hydrogen sulphide, methane and carbon monoxide gas traces are predominantly recognized in septic tank gases. Sensors are used to measure the quantity of toxic gas detected in the waste product environment and to give a signal.

The harmful toxins emitted from the waste product, such as hydrogen sulfide, alkane series and carbon monoxide gas, are detected by gas sensors at each moment and modified until they reach the conventional standard. The paper aims to provide an example for the timely tracking of waste product power station or septic system to keep a watch on the level in gas accumulation. In addition to being industrial plants, the system can be created to figure properly in each household through dynamic tiny style specifications. Thing Speak IoT platform would be operated from all over the world via the internet for remote monitoring to contamination or toxicity values. This research also recognized the advancement of the Internet of things framework as its main part as the devices for controlling the installation. This

approach offers a complex sewer setting solution than before the existing systems that ignored real-time monitoring and shifts in air concentrations of gases and moisture. This is because the flux of waste product water varies greatly over duration and relies on the lot of different things such as filter quality, accumulation of energy and plant disruption.

II. PROPOSED SYSTEM

The smart drainage system will have: Sensors to detect blockage, flood and gases. The intelligence of sensors and system will identify the clogging inside the drainage system and will give the details of the location and other information for further actions. The system will also sense the presence of various harmful gases such as Methane (CH₄), Sulphur dioxide (SO₂), Carbon monoxide (CO) etc. As the level of such gases pass the threshold value the system will generate the alert using alarm system by which the Health department will take proper action on it. The module is implemented using Wireless Sensor Networking (WSN) technology each node will carry its own data along with the data of neighbouring node and will pass it to next node by hopping techniques. These entire data packet will be collectively sent by the gateway node and stored at the cloud all these data will be accessible in real-time scenario for continuous monitoring. Drainage systems indicate the presence of gases, namely sulfur dioxide, methane, ammonia, nitrogen dioxide, carbon dioxide, and carbon monoxide.

Therefore these toxic gases are hazardous, and sometimes lead to their death, particularly for sewage workers and cleaners. Hence, an IoT-based monitoring system is being introduced to avoid exposure to such workplace hazards. Previous programs suggested manual sampling for the sewer gas analysis at defined time intervals. As humidity, temperature and generation of live videos were not considered. Using the latest design, the drawbacks of the current system will be addressed. In addition to the gas sensors, the humidity and temperature sensors can aid in assessing the overall environment of the Sewage.

A. Block Diagram

The diagram shows the parts and the connection between them so it can be easily identified. The parts are as follows:

- Arduino UNO R3 Microcontroller
- Power Supply
- Gas Sensor
- Relay

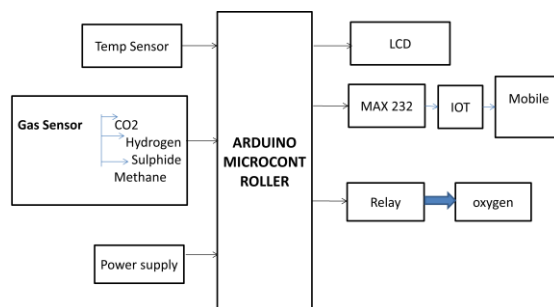


Fig.1. Block Diagram

B. Working principle

The smart drainage system will have: Sensors to detect blockage, flood and gases. The intelligence of sensors and system will identify the clogging inside the drainage system and will give the details of the location and other information for further actions. The system will also sense the presence of various harmful gases such as Methane (CH₄), Sulphur dioxide (SO₂), Carbon monoxide (CO) etc. As the level of such gases pass the threshold value the system will generate the alert using alarm system by which the Health department will take proper action on it. The module is implemented using Wireless Sensor Networking (WSN) technology each node will carry its own data along with the data of neighbouring node and will pass it to next node by hopping techniques. These entire data packet will be collectively sent by the gateway node and stored at the cloud all these data will be accessible in real-time scenario for continuous monitoring. Drainage systems indicate the presence of gases, namely sulfur dioxide, methane, ammonia, nitrogen dioxide, carbon dioxide, and carbon monoxide.

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C. *Power supply*

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging a 2.1mm centre- positive plug into the board's power jack. Leads from a battery can be inserted in the GND and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts. The power pins are as follows:

VIN.- The input voltage to the Arduino board when it's using an external power source (as opposed to 5 volts from the USB connection or other regulated power source). You can supply voltage through this pin, or, if supplying voltage via the power jack, access it through this pin.

5V.- The regulated power supply used to power the microcontroller and other components on the board. This can come either from VIN via an on-board regulator, or be supplied by USB or another regulated 5V supply.

3V3 - A 3.3 volt supply generated by the on-board regulator. Maximum current draw is 50 mA.

GND. Ground pins.

III. BASIC DESIGN AND OPERATION

A simple electromagnetic relay consists of a coil of wire wrapped around a soft iron core, an iron yoke which provides a low reluctance path for magnetic flux, a movable iron armature, and one or more sets of contacts (there are two in the relay pictured). The armature is hinged to the yoke and mechanically linked to one or more sets of moving contacts. It is held in place by a spring so that when the relay is de-energized there is an air gap in the magnetic circuit. In this condition, one of the two sets of contacts in the relay pictured is closed, and the other set is open. Other relays may have more or fewer sets of contacts depending on their function. The relay in the picture also has a wire connecting the armature to the yoke. This ensures continuity of the circuit between the moving contacts on the armature, and the circuit track on the printed circuit board (PCB) via the yoke, which is soldered to the PCB.

When an electric current is passed through the coil it generates a magnetic field that activates the armature and the consequent movement of the movable contact(s) either makes or breaks (depending upon construction) a connection with a fixed contact. If the set of contacts was closed when the relay was de-energized, then the movement opens the contacts and breaks the connection, and vice versa if the contacts were open. When the current to the coil is switched off, the armature is returned by a force, approximately half as strong as the magnetic force, to its relaxed position. Usually this force is provided by a spring, but gravity is also used commonly in industrial motor starters. Most relays are manufactured to operate quickly. In a low-voltage application this reduces noise; in a high voltage or current application it reduces arcing.

When the coil is energized with direct current, a diode is often placed across the coil to dissipate the energy from the collapsing magnetic field at deactivation, which would otherwise generate a voltage spike dangerous to semiconductor circuit components. Some automotive relays include a diode inside the relay case. Alternatively, a contact protection network consisting of a capacitor and resistor in series (snubber circuit) may absorb the surge. If the coil is designed to be energized with alternating current (AC), a small copper "shading ring" can be crimped to the end of the solenoid, creating a small out-of-phase current which increases the minimum pull on the armature during the AC cycle.

IV. HARDWARE IMPLEMENTATION

This system consists of Arduino UNOR3 Microcontroller. This system has Gas Sensor, Relay and oxygen cylinder. Gas sensor is used to sense the toxic gas inside the sewage. If any gas is detected in the gas sensor, then the Arduino will send an alert message to the authorized person and Arduino turn ON the oxygen cylinder.



Fig.2. Hardware Setup

It has temperature sensor which is used for measure the human temperature. In LED display, it shows temperature and gas type.

V.CONCLUSION

Internet of Things has gained its wide popularity in recent days due to its various streams of applications which has paved way for smooth, safe and easier mode of living style for human beings. Though, several techniques are existing for the same, yet sewage cleaning is one major concern and a challenge always. This paper thus put forth a new proposed system which is microcontroller based application of sewage workers health monitoring systems using IOT. This device is designed keeping in mind, the measurement of necessary parameters, which needs to be monitored for unhindered safety of the workers. The device finds major application in household sewage systems, municipal manholes and sewage, sewer, deep well, gutters and drains etc. However, the places where toxic gases or fumes are present should never be handled by human workers directly. The proposed methodology helps to prevent the sudden accident of workers and also helps to keep the society clean. The smart safety device is cost wise less and fast in accessing the WSN and transfers the information to both the concerned department and emergency department. The proposed device helps the worker at a basic level of knowledge to understand the gas level and his pulse rate. The smart device can be implemented and used across the world and also helps to monitor the overflow of the sewage water.

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