SAFETY MONITORING OF SEWAGE WORKERS USING IOT AND MACHINE LEARNING

College   : *East West Institution of Technology, Bangalore*
Branch   : *Department of Information Science and Engineering*
Guide(s)   : *Prof. Bhavya T*
Student(S) : *Mr. Raviteja R*
                  Mr. Vamshi S
                  Mr. Rohith N
                  Mr. S Sushan

Keywords

Internet of Things, Application Programming Interface, Machine Learning, Real-time System

Introduction

Many types of researches and surveys have revealed that the lack of treatment of sewage after crossing dangerous levels leads to the deaths of thousands of sewage cleaners throughout the year. This proves inadequacy in our health monitoring system. The proposed system provides a method to keep a track of the health status of these workers and also ensure their safety. The hardware of the system can be attached through a wrist band or inserting into the jacket making it wearable for the workers. Effluent around the IOT system and network that detect toxic gases has been developed as a measure to help sanitation staff who risk 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. 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 methane and carbon monoxide gas, are detected by gas sensors at each moment and modified until they reach the conventional standard. The main reason behind this is that the workers are sent into the sewers without any safety equipment. Real time health monitoring systems for such workers will be helpful to save their lives. Gases like Carbon Monoxide, Methane gas, Hydrogen Sulphide gas are very toxic. So, our problem of interest is to develop a device that will detect the harmful gases, temperature inside the manhole and

heartbeat of the worker so that if anything is not under the normal buzzer is activated and the worker is saved on time by sending alert message to exterior unit. The proposed system will be installed in both remote and urban, indifferent locations. The data obtained on the cloud is then used by Machine Learning Model for further systematic analysis making smart use of this data in order to predict the condition of the worker with considerable reliability and accuracy.

Objective

The condition of the sewage acts as an input using Temperature sensor, ultra-sonic water level sensor, Gas sensor detectors. It measures and analyse the real-time levels of toxic gases in order to ensure safety of the workers working under such severe conditions.

(a) To Decrease the rate of danger that is caused due to the scavenging and the ways of sewerage monitoring.

(b) To avoid the floods that occurred in India was because there was no proper sewage management resulting in the loss of many lives and also loss of wealth.

(c) To alert the worker and exterior unit if any parameters exceed.

(d) To sense the toxicity of gas, as well as sending automatic SMS, if the toxicity of the gas measured is above an expected normal range.

(e) To obtain an effective low-cost and flexible solution for checking and keeping an update on sewage environment using sensors.

(f) For 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 another reason so as to innovate the present systems.

(g) To check the health state of the workers using machine learning.

Methodology

Algorithm for Controller:

Step 1: Initializing the controller by providing power supply and initializing the sensors and actuators.

Step 2: Connecting the controller to the server and cloud through internet.

Step 3: Reading the values from the sensors and pushing the values to the cloud.

Step 4: Retrieving the values from the cloud and displaying on the mobile application.

Step 5: Comparing the values of the sensor with the threshold value and alerting if it crosses the threshold value.

Steps involved in Random Forest Algorithm for predicting health condition:

Step 1: In Random Forest n number of random records are taken from the data set having k number of records.

Step 2: Individual decision trees are constructed for each sample.

Step 3: Each decision tree will generate an output.

Step 4: Final output is considered based on Averaging for Classification and regression respectively

ARCHITECTURE

Sensors to detect floods, and gases will be included in the smart drainage system. The sensors' and system's intelligence will detect clogs inside the drainage system and provide location specifics and other information for further action. Various dangerous gases, such as methane (CH4), sulphur dioxide (SO2), carbon monoxide (CO), and others, will be detected by the system.

As the level of these gases exceeds the threshold value, the system will issue an alert via an alarm system, prompting the Health Department to take appropriate action. The module is developed utilizing Wireless Sensor Networking (WSN) technology, in which each node carries its own data as well as data from nearby nodes and passes it on to the next node using hopping techniques. The gateway node will send all of these data packets together and store them in the cloud, where they will be accessible in real-time for continuous monitoring.
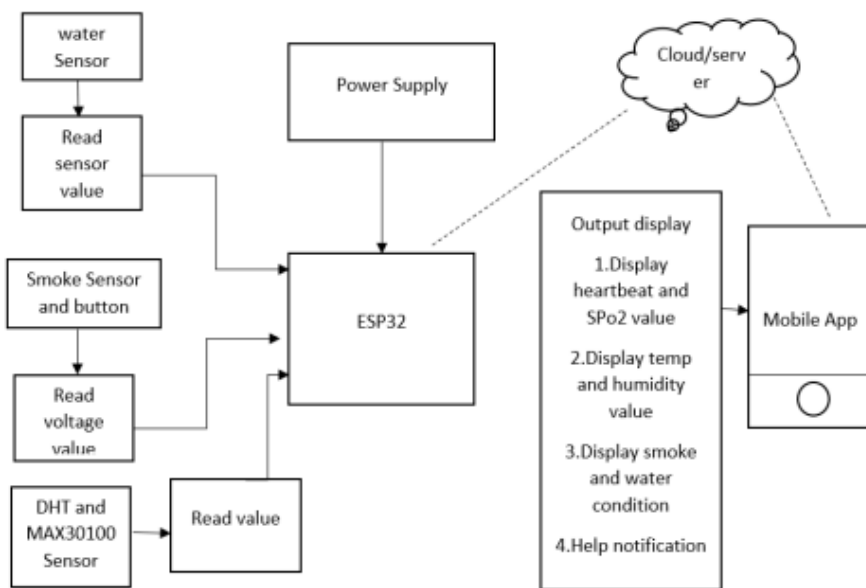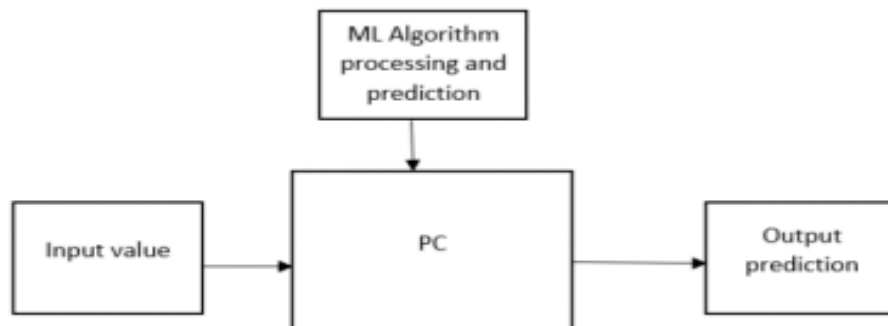

Fig 1.2: System Design of IOT sensors

Results and Conclusion

All the data readings received from the sensors are stored in cloud and a copy of data is sent to mail for further analysis of data. Alert messages will be generated when toxic gases detected above threshold values, pulse rate and temperature of worker indicates trouble. Using Machine Learning, the data obtained on the cloud is then used by Machine Learning Model for further systematic analysis making smart use of this data in order to predict the condition of the worker with considerable reliability and accuracy.

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Sewage gases are toxic and can cause chronic illnesses and death if high concentrations are released into the body. These toxic gases are particularly dangerous for sanitation workers, and they can even cause death. Therefore, to prevent these hazards, an IOT based safety for sewage workers was proposed and designed which monitors toxic gases levels and heart rate of the worker in sewage. If any of the parameters divert from threshold values then an alert will be given to the exterior unit using SMS before any harm. Predict the condition of the worker with considerable reliability and accuracy, using ML algorithm.

Future Work

This system can be used in sewage environment which can save lives of sewage worker. In the future, the system can be upgraded with new technologies such as sewage workers tracking system and deep learning techniques using CNN by image processing, sewage water toxicity level detection which makes this system more efficient in alerting the sewage workers and the higher authorities to take right decision. This system with

advanced technology based on IOT will significantly impact the lives of sewage workers. By including more sensors for other toxic gases like Sulphur dioxide, hydrogen sulphide (H2S), methane etc. we can improve design further. Moreover, by introducing new functionalities like location services, tracking and modified alert system, this design can serve a great social cause. Hence, this project will be able to aid the department of health and sanitation, and help fulfil a social cause for the country.