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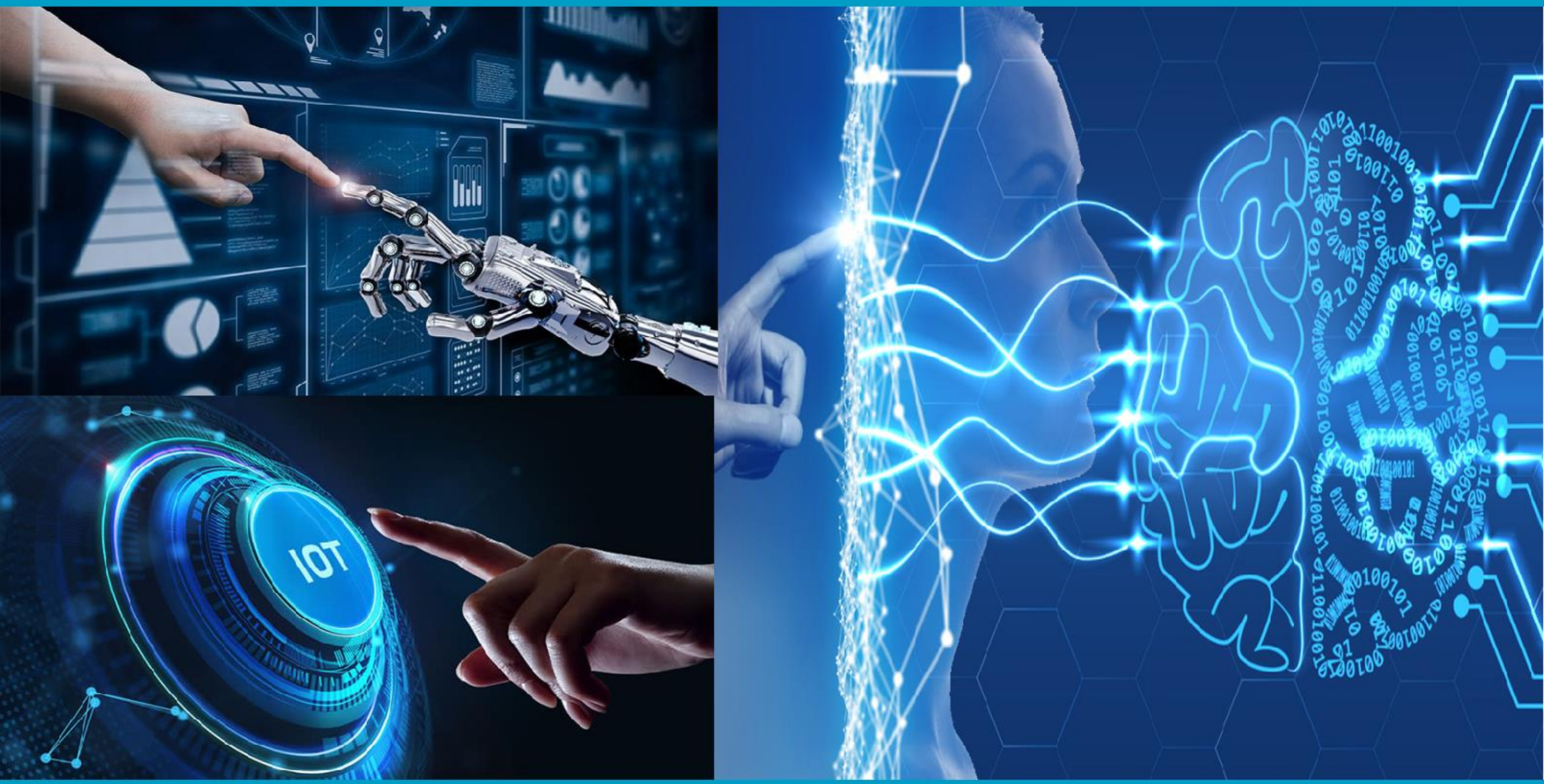

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Sewage Monitoring System using Gas Sensor and Alert System through Mobile Application

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ABSTRACT : This paper presents a detailed exploration of a real-time sewage monitoring systemdesigned to detect and mitigate the risks associated with toxic gas emissions in sewage systems.The system integrates gas sensors, a microcontroller, GSM module, and a mobile application toprovide continuous monitoring, timely alerts, and user-friendly visualization of gas levels. Byaddressing the limitations of existing manual and automated sewage monitoring methods, theproposed system aims to enhance environmental safety and improve response times to hazardoussituations. The methodology involves deploying gas sensors capable of detecting methane (CH4),hydrogen sulfide (H2S), and other relevant toxic gases in sewage systems. These sensorscontinuously monitor gas levels, and when predefined thresholds are exceeded, they send signalsto a microcontroller for processing. The microcontroller then triggers the GSM module to sendalertstoadesignatedmobileapplication,providingstakeholderswithreal-timenotifications.Themobile application allows users to view gas levels, receive alerts, and access historical data forinformed decision-making. The paper discusses the system architecture, including UMLdiagrams illustrating component interactions and data flow. Additionally, it presents acomparative analysis with existing sewage monitoring approaches, highlighting the advantagesand limitations of the proposed system. The study concludes with insights into futureenhancements, emphasizing the system's potential for further innovation in sewage managementandenvironmentalmonitoring.

KEYWORDS: Monitoring,Alertsystem,gassensors.

I. INTRODUCTION

Sewage management is a critical aspect of public health and environmentalprotection, with a myriad of challenges that need to be addressed. The traditionalsewage management systems rely on periodic inspections and manual monitoring,which are often labor-intensive, time-consuming, and prone to errors. Moreover, thelackofreal-timemonitoringandalertsystemsfortoxicgasesinsewagemanagementcan lead to serious health and environmental hazards.The importance of real-timemonitoringfordetectingtoxicgasesinsewagemanagementcannotbeoverstated.

Thepresenceoftoxicgasessuchasmethane(CH4)andhydrogensulfide(H2S)canhave detrimental effects on the health of sewage workers and the surroundingcommunity. Real-time monitoring can help detect the presence of these gases at anearlystage,enablingtimelyinterventionsandpreventivemeasures.

Motivationfordevelopinganautomatedsewagemonitoringsystemisdrivenbytheneed to address the challenges of traditional sewage management systems. Anautomated sewage monitoring system that integrates gas sensors, microcontrollers,and GSM modules can provide real-time monitoring and alert systems for toxicgases,enablingtimelyinterventionsandpreventivemeasures.

Theproposedautomatedsewagemonitoringsystemconsistsofseveralmodules,eachwith a specific function. The system architecture is designed to be modular, allowingforeasyintegrationandmaintenance.

The first module is the gas sensor module, which consists of several gas sensors that detect the presence of toxic gases such as methane (CH4) and hydrogensulfide (H2S). The gas sensors are connected to a microcontroller,whichprocessesthesensor data and sends it to the central monitoring system.The second module is themicrocontroller module, which is responsible for processing the sensor data andsending it to the central monitoring system. The microcontroller is programmed toperform several functions, such as data filtering, data aggregation, and datatransmission.The third module is the GSM module, which is responsible for sendingreal-timealertstosewageworkersandthesurroundingcommunity.TheGSMmoduleis connected to the microcontroller and is programmed to send alerts via SMS oremail.The fourth module is the central monitoring system, which receives the sensordata from the gas sensor module and displays it in real-time. The central monitoringsystem is designed to be user-friendly and can be accessed remotely via a webinterface.The fifth module is the database module, which stores the sensor data forfuture analysis and reporting. The database module is designed to be scalable and canhandlelarge volumes of data.

The proposed automated sewage monitoring system provides several benefits overtraditional sewage management systems. The system can detect the presence of toxicgasesinreal-time,enablingtimelyinterventionsandpreventivemeasures.Thesystem can also reduce the need for labor-intensive and time-consuming manualmonitoring.In summary, the proposed automated sewage monitoring system is amodularandscalablesolutionthatcanprovidereal-timemonitoringandalertsystemsfortoxicgasesinsewagemanagement.Thesystemcanhelpaddressthechallengesoftraditional sewagemanagementsystemsandimprovepublichealthandenvironmentalprotection.

II. LITERATUREREVIEW

Literaturesurveyisthemostimportantpartoftheprojectdevelopment,becauseifaproject has to be developed there should be a strong base, problem statement and aproposed system. The analysis of previous works includingPublished journals,BooksorWebsiteswillbeconsideredinthedevelopmentofproposedsystem.

Maira Alvi, Tim French, Rachel Cardell-Oliver, Philip Keymar, Andrew Ward,"CostEffectiveSoftSensingforWastewaterTreatmentFacilities",2022.
Wastewatertreatmentplantsarecomplex,non-linear,engineeredsystemsofphysical,biological and chemical processes operating at different timescales. Sensor systemsare used to monitor wastewater treatment plants in order to ensure public safety andfor efficient management of the plants. However, parameters of interest forwastewater can require expensive or inaccurate sensors or may require off-sitelaboratory analysis. For example, ammonium is important as a prime indicator oftreatmentefficiencyandishighlyregulatedindischargewater.Butammonium sensors are also expensive at over $10,000 (AUD) per sensor. Soft sensors arecomputational models that accurately estimate process variables using themeasurements from few physical sensors and can offer a cost-effective substitute forexpensive wastewater sensors such as ammonium. In this paper, we propose a hybridneural network architecture for learning soft sensors for complex phenomena. Ournetwork architecture fuses sequential modelling with Gated Recurrent NeuralNetwork units (GRUs) to capture global trends, with Convolution Neural Network(CNN) kernels to facilitate learning of local behaviours. We demonstrate theeffectiveness of our technique using real-world data from a wastewater treatmentplant with two-stage high-rate anaerobic and high-rate algal treatments. Secondly, wepropose a novel data preparation algorithm that enables the deep learning techniquestolearnfromalimiteddataandfacilitatesfairevaluation.Wedevelopandlearnasoftsensor to predict ammonium and study its generalization. Our results demonstrate fitfor purpose accuracy and that the soft sensor model is able to capture complextemporal patterns of the ground truth sensor time series. Finally, we publicly releasean annotated data set of a secondary wastewater treatment plant to accelerate theresearchinthedevelopment of softsensors.

Ranya M. M. Salem, M. Sabry Saraya , Amr M. T. Ali-Eldin, (Senior Member, IEEE),"AnIndustrialCloud-BasedIoTSystemforReal-TimeMonitoringandControllingofWastewater", 2022.
Wastewater treatment is considered the most important process for reducingpollutants in wastewater to levels that nature can cope with. At many sewagestreatment plants, industrial wastes cause more difficulties in the treatment processthan any other single problem where the plant operators have to deal with. Theseplants may not be designed to handle these types of wastes and the accelerateddeterioration of sewage treatment plant structures. In this paper, we propose a newindustrial IoT cloud-based model for real-time wastewater monitoring andcontrolling. The proposed system monitors the power of hydrogen (pH) andtemperature parameters from the wastewater inlet that will be treated in thewastewater treatment plant, thereby avoiding impermissible industrial wastewaterthat the plant cannot handle. The system collects and uploads real-time sensorreadings to the cloud via an IIoT Wi-Fi Module. Additionally, it reports observed oridentified unexpected industrial wastewater inlets via SMS notifications and alarmsandcontrolsthevalvesofthegates.Thisisneededtochangethepathofthewatertotheindustrialwastewatertreatmentplantt hatcantreatthistypeofwastes. Experimentalworkshowstheeffectivenessoftheproposedsystemcomparedtorelatedwork.

Chunming Qiu, Guoxiang Shao, Zhenyu Zhang, Chichun Zhou, Yuejie Hou,EnmingZhao,XiaoGuo,XiaolinGuan,"UnsupervisedRealTimeandEarlyAnomaliesDetectionMethodforSewerNetworksSystems",2024
Sewer networks (SNs) are susceptible to various factors that can lead to failures,resulting in economic losses and

environmental pollution. Data-driven approachesbased on sewage flow monitoring enhance the awareness and maintenancecapabilities of SNs. However, the current research lacks early warning systems forflow anomalies. This presents a challenge for the application of supervised methods,primarilyduetothescarcityofanomalousflowdatasets.Evenwiththeavailabilityofsuch datasets, the effectiveness of these methods may vary due to environmentaldifferences, since SNs are situated in diverse environments. Therefore, effectivelyachieving early warnings for anomalies in unlabeled flow data is a challenge thatmust be addressed in the field of flow monitoring. To address this challenge, wepropose a detection method for effectively warning of anomalies in flow data. Sinceanomalies typically result in significant deviations from normal data, early warningscanbeachievedbycomparingthedifferencesbetweencurrentandhistoricaldata.

Thekeytothisearlywarningliesinestablishinganadaptivethresholdfordetectingabnormal data changes. Our detection method employs an unsupervised bagging-basedmultianomalydetectionalgorithmtodetectsuchabnormaldatachanges. Experiments conducted on Erhai Lake SNs flow data demonstrate that our methodcanpredictanomalies5-15minutesinadvancewithaprecisionof80.00%,arecallof66.67%, and an F1 score of 0.73. Our approach not only achieves cost-effective andtimely anomalies detection but also overcomes the challenges associated with limiteddatasetavailability,makingitapplicabletovariousotherindustries.

FernandoSolano, SteffenKrause, ChristophWollgens, "AnInternet-of Things Enabled Smart System for Waste water Monitoring",2021

We present and evaluate an IoT-enabled sensing and actuating system for localizingillegal industrial harsh discharges of polluting wastewater in sewer networks. ThespecialconditionsofthesewerenvironmentbringspecialchallengesforthedesignofanIoTsystemandofitsreal-timealgorithmforanomalydetectionandlocalizationinwastewater networks. The proposed design fulfills these requirements by using a newIoT architecture pattern, which we generalize and name Hop-by-hop AnomalyDetection and Actuation (HADA). The distributed anomaly detection and localizationalgorithm makes predictions over previous sensor measurements, while taking intoaccount seasonality effects of wastewater and noise of the sensors. Based onsimulations in a large network with three common illegal industrial wastewaterpollutants, the advantages and limitations of the proposed wastewater anomalylocalization system are discussed. The IoT system, including its anomaly detectionand localization algorithm, was implemented using in a low-power microcontrollerandtestedinflowingwastewaterwithdifferentharshindustrialwaste.

Ahmad Alshami, Moustafa Elsayed, Eslam Ali, Abdelrahman E. E. Eltoukhy, TarekZayed,"MonitoringBlockageandOverflowEventsinSmall-SizedSewerNetworkUsingContactlessFlowSensorsinHongKong:Problems,Causes,andProposed Solution",2023

Effective monitoring and prediction systems for sewer overflow are essential forsafeguarding public health and the environment. Flow sensors have emerged asvaluable tools for understanding and measuring the hydraulic performance of sewernetworks, enabling the detection of blockages and overflow events. However,previous research has predominantly focused on large-diameter sewer networks,leaving a gap in understanding the applicability and performance of flow sensors insmall and medium-sized systems. Addressing this research gap and motivated by theneed to improve the monitoring of small and medium-sized sewer networks, thisstudy comprehensively assesses the performance of flow sensors in such networks,with a focus on detecting blockages and overflow. The study evaluates theperformance of flow sensors in 12 locations within the Hong Kong sewer networkand identifies challenges affecting accuracy. The findings reveal noteworthyshortcomings when solely relying on flow sensors, including inconsistent andunreliable observations. Notably, the correlation coefficient between the level andflowsensorswas0.36,andtheaveragerelativeerrorinflowratemeasurementwasasubstantial 72.14% compared to Manning's equation. An in-depth analysis revealskey factors hindering flow sensors' efficiency, such as inconsistent flow directionsand pipe size variations. To overcome these limitations, the study introduces a newapproach based on real-time measurement of vertical sewage velocities insidemanholes. By incorporating level sensors and considering specific networkcharacteristics, this alternative methodology provides a promising solution fordetecting operational issues and improving the reliability of overflow monitoringsystems.

III. METHODOLOGY

The proposed method entails the design and implementation of a sewage monitoringsystem integrating gas sensors, a microcontroller, GSM module, and mobileapplication. Gas sensors are strategically deployed to detect methane, hydrogensulfide,andothertoxicgasesinsewagesystems,withcalibrationproceduresensuringaccurate measurements. Firmware development for the microcontroller enables real-

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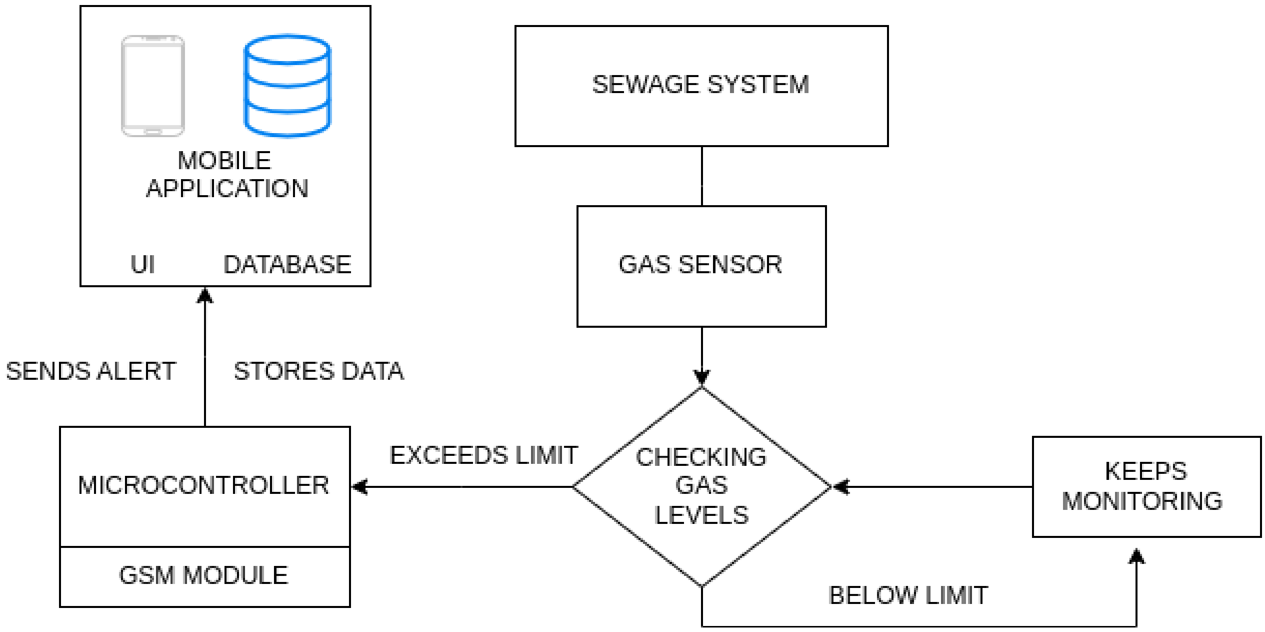
timemonitoringofgaslevels,thresholddetection,andtriggeringofalertmechanisms. Integration of the GSM module facilitates communication for alertmessages to designated recipients. A mobile application, developed using Java forAndroid platform, provides a user-friendly interface for viewing gas levels, receivingalerts, and accessing historical data stored in a local SQLite database. Rigoroustesting, deployment in real-world settings, and stakeholder feedback drive iterativeimprovements to enhance system functionality, reliability, and usability. Findings aredisseminated through technical documentation and publication, contributing toadvancementsinsewagemanagementandenvironmentalmonitoring.

IV. ARCHITECTUREDIAGRAMOFTHEPROPOSEDSYSTEM



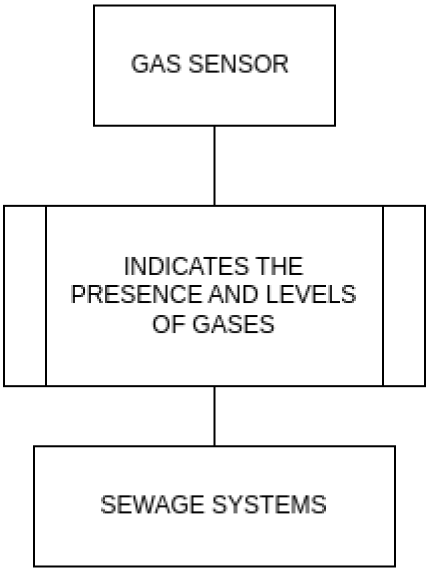
This architecture diagram illustrates the components and flow of the sewagemonitoring system. At the core of the system is the sewage system itself, which ismonitored by gas sensors capable of detecting methane, hydrogen sulfide, and othertoxic gases. These sensors continuously monitor gas levels and feed the data to amicrocontroller. The microcontroller is responsible for processing the sensor data andmaking decisions based on predefined thresholds. If the gas levels exceed the limit,the microcontroller triggers the GSM module to send an alert to the mobileapplication. Additionally, the microcontroller stores the data in the database for futurereference.Themobileapplicationservesastheuserinterface(UI)forinteractingwiththe system, allowing users to view real-time gas levels and receive alerts. Thedatabase component stores gas level data, user preferences, and systemconfigurations. Overall, this architecture ensures real-time monitoring of sewage gaslevels, timely alerts, and data storage for informed decision-making and systemmanagement.

V. RESULTS AND DISCUSSIONMODULESIDENTIFIED:

Gas Sensor Module, GSM Module, Microcontroller Module, MobileApplicationModule(UserInterface, Database).

GASSENSOR:
Gassensorsaredeployedwithinthesewagesystemtodetectspecificgasessuchasmethane(CH_4),hydrogensulfide(H_2S),andothertoxicgases
Thesesensorscontinuouslymonitorgaslevelsinthesewage,providingreal-timedata on gas concentrations.
Gassensorsareselectedbasedontheirsensitivity,accuracy,andcompatibilitywiththesewageenvironment.
Calibrationproceduresareimplementedtoensureaccuratemeasurementofgasconcentrationsundervaryingenvironmentalconditions.

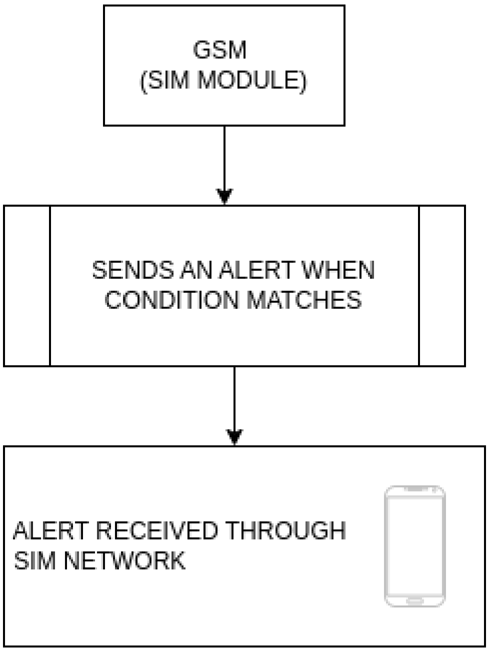
DIAGRAM:



GLOBALSYSTEMFORMOBILECOMMUNICATION(GSM):

TheGSMmoduleenablescommunicationviaGSMnetworks,facilitatingthetransmissionofalertmessagestodesignatedrecipients.
Itreceivessignalsfromthemicrocontrollerwhengaslevelsexceedpredefinedthresholdsandinitiatesthealertingprocess.
TheGSMmoduleisconfiguredtohandlevariousnetworkconditionsandensurereliable delivery ofalertmessages.
ItmayincorporatefeaturessuchasSMS(ShortMessageService)capabilitiestosendalertstomobilephonesorothercommunicationdevices.

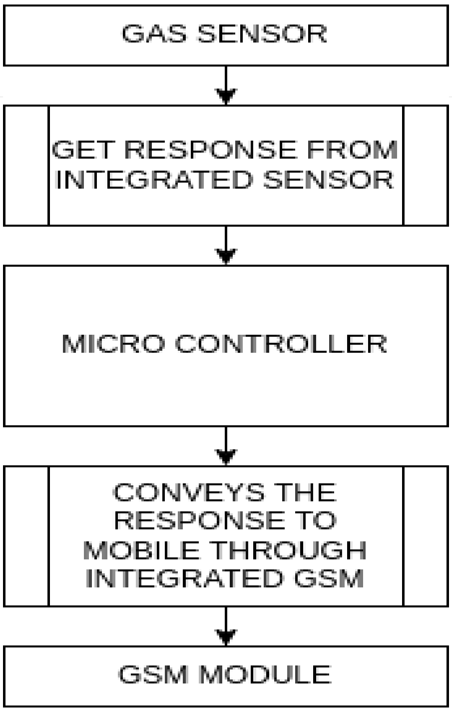
DIAGRAM:



MICROCONTROLLER:
Themicrocontrollerservesasthecentralprocessingunitofthesystem,responsiblefordata acquisition,processing, anddecision-making.
Itreceivesinputfromthegassensors,processesthesensordata,andtriggersactionsbased on predefinedthresholds.

Algorithmsaredevelopedandimplementedonthemicrocontrollertomonitorgaslevels,detectthresholdexceedances,andmanagealertingmechanisms.
Errorhandlingmechanismsareintegratedtoensurerobustoperationandfaulttoleranceof thesystem.

DIAGRAM:



MOBILEAPPLICATION:

USERINTERFACE:

Themobileapplicationprovidesauser-friendlyinterfaceforinteractingwiththesewagemonitoringsystem.
DevelopedusingJavaforAndroidplatform,theapplicationallowsuserstoviewreal-timegaslevels,receivealerts,andaccesshistoricaldata.
ItfeaturesintuitiveUIcomponentsfordisplayingsensordata,configuringalertthresholds,andmanaginguserpreferences.
Theapplicationintegrateswiththelocaldatabasetostoreandretrievegasleveldata,usersettings,andsystemconfigurations.

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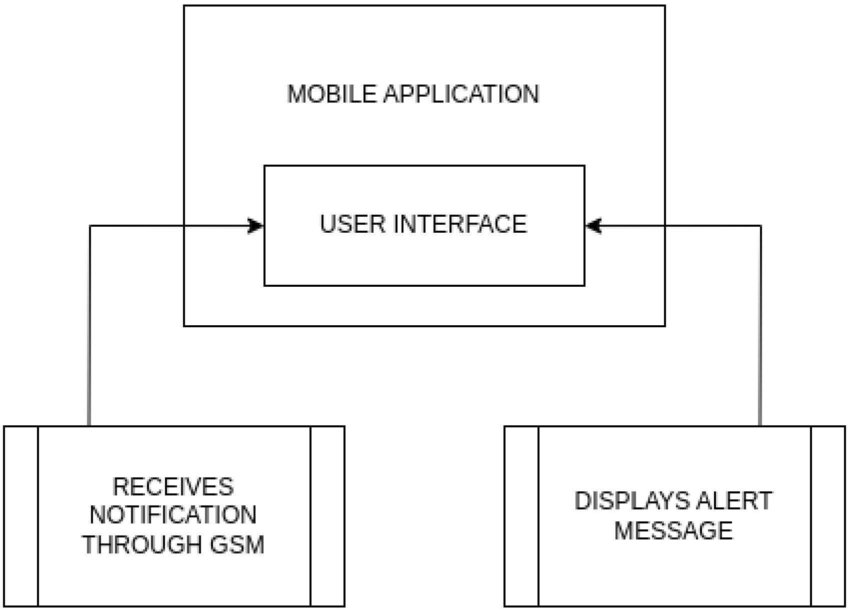
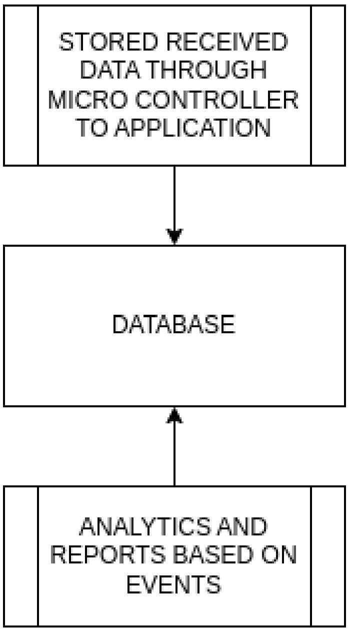
DIAGRAM:



DATABASE:

Thedatabasecomponentstoresgasleveldata,userpreferences,andsystemconfigurationsfor futurereference andanalysis. ImplementedusingSQLite,thedatabaseprovidesefficientdatastorageandretrievalcapabilitieson themobiledevice. Itstoressensorreadings,timestamps,alertthresholds,andotherrelevantinformationrequiredforsystemmanagement. CRUD(Create,Read,Update,Delete)operationsareimplementedtomanage datawithinthedatabase,allowingforseamlessinteractionwiththemobileapplication.

DIAGRAM:



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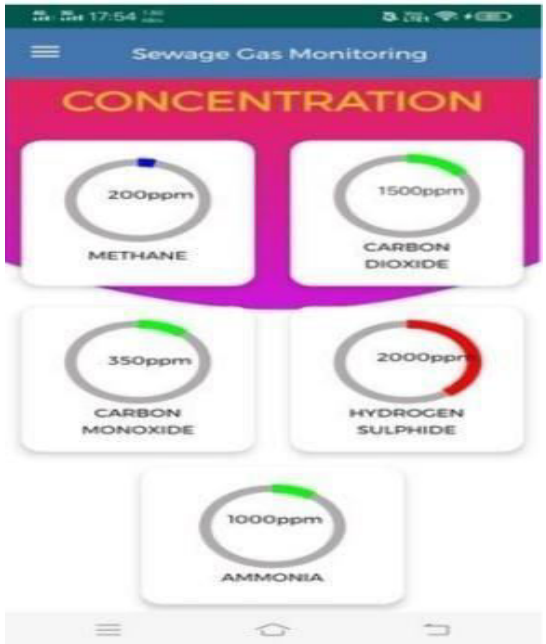
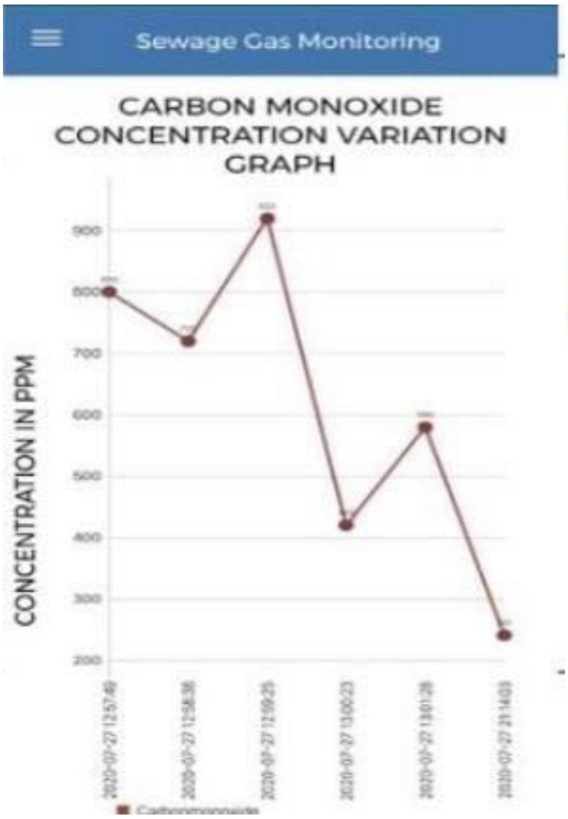
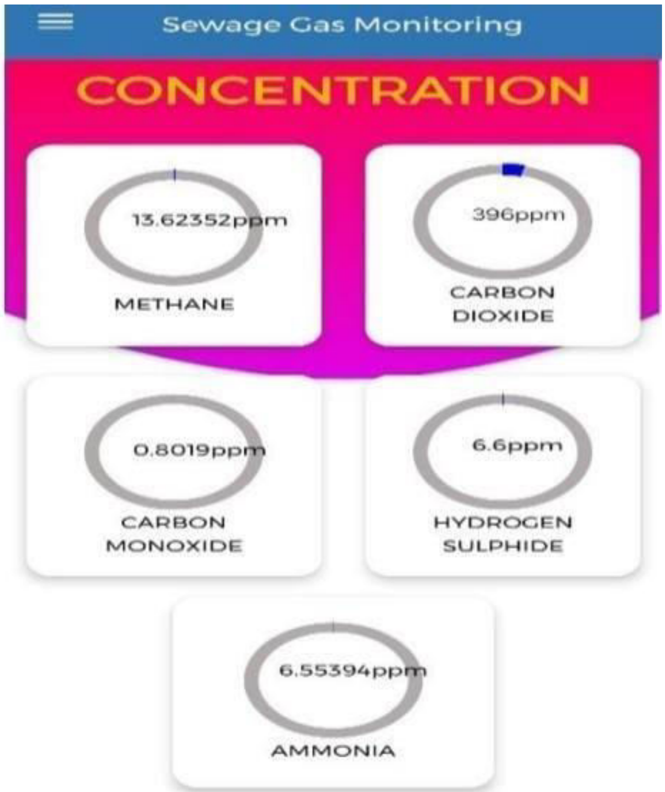
SAMPLEOUTPUT:







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V. CONCLUSION

A Parallel and Scalable of Erasure Coding Support in Cloud Object Storage System

Pon Sangeetha A 1, Rohith Vignesh G 2, Lingeswaran R 3, Mukesh D 4
Assistant Professor, Department of Computer Science and Engineering, Velammal Institute of Technology, Panchetti, Chennai, Tamil Nadu, India1
UG Scholar, Department of Computer Science and Engineering, Velammal Institute of Technology, Panchetti, Chennai, In conclusion, the development and implementation of the sewage monitoring systempresented in this paper represent a significant advancement in environmentalmonitoring technology. By integrating gas sensors, a microcontroller, GSM module,and mobile application, the system enables real-time monitoring of toxic gas levels insewage systems, timely alerts, and user-friendly interaction for stakeholders. Theproposed system addresses the limitations of existing sewage monitoring methods byprovidingcontinuousmonitoringcapabilities,immediatealerts,anddatavisualizationthrough a mobile interface. Through rigorous testing and field evaluation, the systemhas demonstrated its effectiveness in detecting gas leaks, providing timely alerts, andfacilitating informed decision-making for sewage management. The modulararchitecture of the system allows for scalability, maintenance, and futureenhancements to meet evolving environmental monitoring requirements. Overall, thesewage monitoring system offers a comprehensive solution for mitigatingenvironmental risks, enhancing public safety, and ensuring the sustainablemanagement of sewage systems. Future research endeavors may focus on furtheroptimization, integration with advanced sensor technologies, and expansion intobroaderenvironmentalmonitoringapplications.

REFERENCES

[1] Ahmad Alshami, Moustafa Elsayed, Eslam Ali, Abdelrahman E. E. Eltoukhy,Tarek Zayed, "Monitoring Blockage and Overflow Events in Small-Sized SewerNetworkUsingContactlessFlowSensorsinHongKong:Problems,Causes, andProposedSolution",2023
[2]FernandoSolano,SteffenKrause,ChristophWollgens,"AnInternet-of-ThingsEnabledSmartSystemforWastewaterMonitoring",2021
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[4]Ranya M. M. Salem, M. Sabry Saraya , Amr M. T. Ali-Eldin, (Senior Member,IEEE), "An Industrial Cloud-Based IoT System for Real-Time Monitoring andControllingofWastewater",2022.
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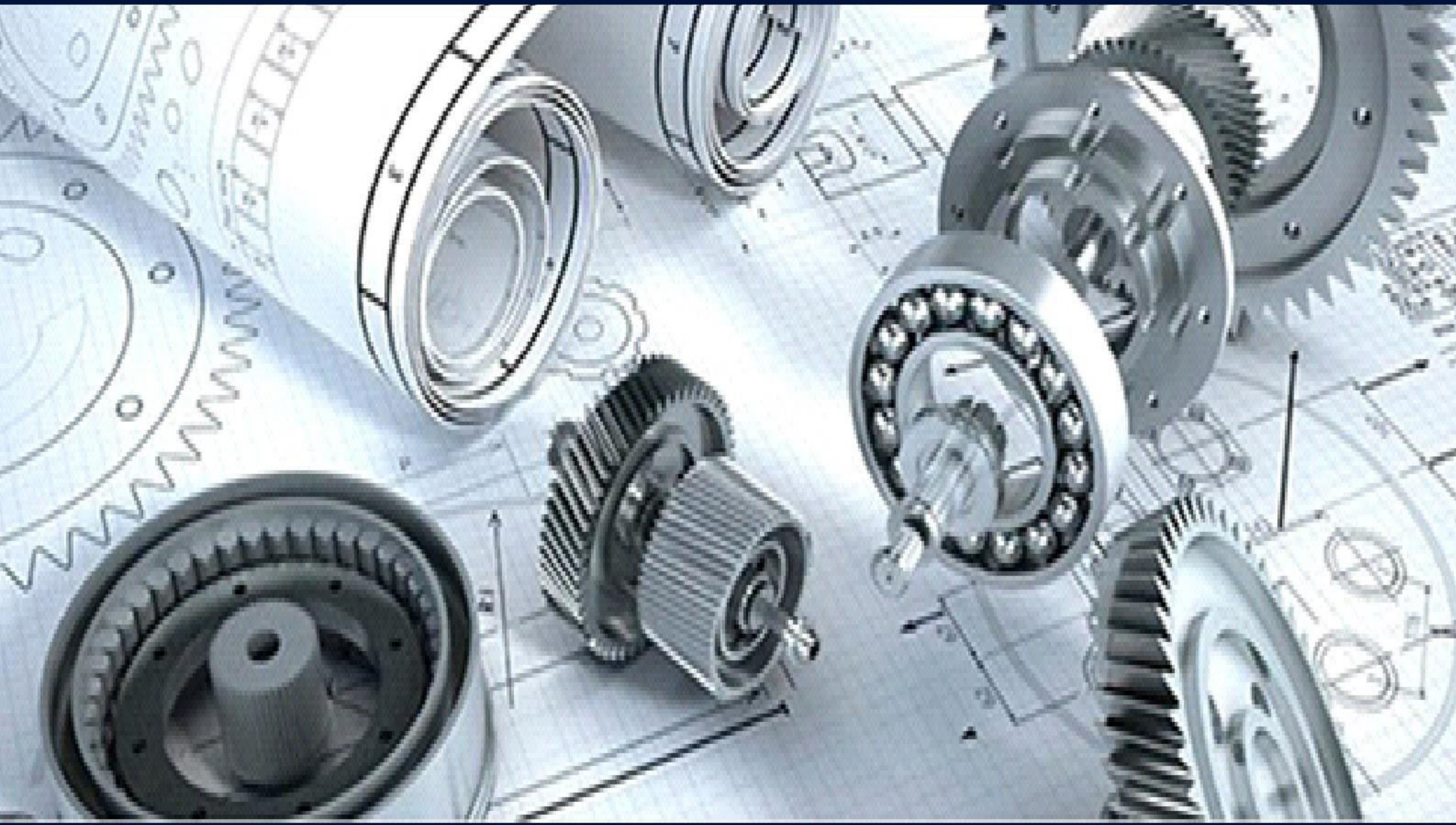

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