IJCRT.ORG ISSN : 2320-2882

INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

SMART SAFETY MONITORING SYSTEM FOR SEWAGE WORKERS WITH TWO WAY COMMUNICATION

[1]Anusha.B, [2]Shreyas M, [3]Trishya V, [4]Ventakesh Raju G, [5]Y Shireesha

[1] Assistant Professor, [2] Student, [3] Student, [4] Student, [5] Student

Department of Information Science and Engineering,
Cambridge Institute of Technology, Bangalore, India

Abstract: A large number of sanitation workers die every year due to erratic and lack of facilities available, and harmful toxic gases released while cleaning the sewage. This can include monitoring the environment for air quality, temperature, humidity, and sound levels, as well as tracking employee activity and movement. This project aims to develop an innovative Smart Safety Monitoring System (SSMS) for sewage workers, leveraging the capabilities of the Internet of Things (IoT) technology. Real time health monitoring systems for such workers will prove helpful. Sewage workers face numerous risks while performing their duties in confined and hazardous environments. The SSMS is designed to enhance their safety and improve communication. This real time health monitoring device will work in a sewage as a safety equipment. In this project, the device presented will monitor the pulse rate of a person using a pulse oximetry sensor, the methane concentration and the atmospheric oxygen concentration and provide alert to worker and exterior unit. when parameters deviate from the safe range. This parameters in real time will promptly alert the workers to stay safe and detect toxic gases before any harm.

I. Introduction:

The Smart Safety Monitoring System for sewage workers with two-way communication is a comprehensive solution aimed at bolstering the safety and well-being of individuals engaged in sewage maintenance tasks. Deploying wearable devices, such as smart helmets or vests equipped with an array of sensors, the system continuously monitors vital signs and environmental conditions. Biometric tracking ensures real-time assessment of workers' health, promptly alerting in case of anomalies. Environmental sensors detect hazardous conditions, while GPS technology enables precise location tracking. A pivotal feature of the system is its two-way communication, facilitating seamless interaction between workers and a central monitoring station. In emergencies, the system triggers automatic alerts, allowing for swift deployment of response teams based on

GPS data. The collected data undergoes thorough analysis to identify trends and potential risks, enabling informed decision- making. Integration with existing infrastructure ensures a cohesive approach to sewage management, while the system also incorporates training features to educate workers on safety protocols. The overall result is an innovative solution that not only prioritizes the safety of sewage workers but also enhances the efficiency of sewage maintenance operations through real-time monitoring and communication.

II. RELATED WORKS:

[1] "Real-time communication based IoT enabled Smart safety monitoring system for sewage workers" Ajitesh Kumar; Sanjai Kumar Gupta; Manish Rai 2021 5th International Conference on Information Systems and Computer Networks (ISCON) In recent times, technology is growing day byday, well as the trend of IoTs is going to touch the peak. As everything in the world is moving towards automation like Automatic driving cars, Home automation, Automated Irrigation system. This paper proposed a system for the safety of sewage workers while cleaning the sewer lines. This proposed paper explains how efficient a system is in terms of cost and safety too using the internet. Due to safety aspects, this topic is gaining great attention because it works for the life of our heroes who are responsible for the clean environment of the whole world.In this concentration, Air Quality Index of the sewer environment and location tracker, pulse rate detection of the workers. The data collected by the sensors will send to the Blynk cloud for analysis which will send the decision after analysing the data..

[2] "IoT-based Automatic Manhole Observant for Sewage Workers Safety" Rakesh Dronavalli; Kalpana Seelam; Parthive Maganti; Jasmitha Gowineni; Sai Deepthi Challamalla 2022 International Conference on Automation, Computing and Renewable Systems (ICACRS) With the rise in population growth in cities IoT devices are being used in this automated world. With increased population destruction, the probability of accidents increases due to improper infrastructure of roads, drainage systems, and manhole blocks. The proper manhole system should use in cities. Proper manual monitoring of maintenance holes by scavengers is a dangerous job in today's polluted cities it may impact their health and may lead to death. Without being well in, formed the situation manholes may take a way to death. To keep safe this proposed model, aim to provide an automated manhole system that measures temperature, humidity, and harmful gases using sensors and updates this information using IoT applications. If there is any abnormal change in the manhole here this change is measured by the sensors and transferred to the managing station in form of messages to take further action.

[3] "Development of Manhole Cover Detection and Continuous Monitoring of Hazardous Gases using WSN and IoT" Vidhya Sree. A; Sudarmani. R; Vaisali. S; Aishwarya. K 2022 6th International Conference on Computing Methodologies and Communication (ICCMC) In many developing countries manholes are not monitored properly, but for the public safety and security the manhole system should be managed in good condition. Continuous monitoring of manholes is important one in smart city implementation. In the present scenario smart cities doesn't only mean smart traffic lights, smart framing, etc. It must also include smart manhole system. Continuous monitoring of sewage gases present in the system is more important in every smart city implementation. Comparing with other

countries India is overwhelmed with population and sewages. Also, most of the manhole lids are open and not in proper condition. Due to the improper maintenance of gully pot systems, emission of poisonous gases affects the workers, which leads to losing of their lives and even more causes dangerous disease which can easily spread. This paper presents an essential manhole monitoring and detecting system, where the continuous monitoring of hazardous gases, condition of manhole lid using different sensors. The continuous monitoring of the gas levels and lid open condition are captured by the sensing unit and the sensor data are transferred to Atmega 328p microcontroller unit. The processed data will be stored in the cloud for further processing also sent it to the host station using the long- distance communication LoRa module. According to the received data an alert will be provided to the public regarding the manhole cover condition.

III. OBJECTIVES:

The primaryobjectives of implementing a smart safetymanagement system forsewage workers using IoT (Internet of Things) are:

1. Worker Safety
2. Real-Time Monitoring
3. EmergencyResponse
4. Training and Awareness
5. Equipment Monitoring
6. Integration with Other Systems

The main motto of this paper is to provide following objectives:

To alert the worker if any parameter goes beyond its specific range. As soon as the parameter exceeds then the authorizedperson's registered mobile device should get a warning message if the level of dangerous gas exceeds the threshold.

3.2 Data and Sources of Data:

The data for the Smart Safety Monitoring System for Sewage Workers with Two-Way Communication project would be sourced from various avenues. Firstly, field observations would provide direct insights into sewage work environments, encompassing worker activities, safety protocols, environmental conditions, and communication patterns. Surveys and interviews with sewage workers, supervisors, safety managers, and other stakeholders would offer valuable perspectives on safety concerns, communication needs, technological preferences, and user experiences. Additionally, technical assessments of existing safety equipment, communication systems, and monitoring technologies would inform the design and development of the new monitoring system. Real-time data from integrated sensors, including environmental sensors, wearable sensors, and communication modules, would provide critical information on worker safety and system performance. Historical records of safety incidents and health issues among sewage workers could be analyzed to identify recurring patterns. Furthermore, a review of existing literature on sewage worker safety, communication technologies, and related topics would serve as a valuable secondary data source, providing context and supporting the research findings. Collaboration with industry partners, government agencies, research institutions, and technology providers may also grant access to additional data and resources, enriching the research project and its outcomes..

3.3 Theoretical framework:

The theoretical framework for the Smart Safety Monitoring System for Sewage Workers with Two-Way Communication project could be based on several interconnected theories and concepts. Firstly, it could draw upon theories of occupational health and safety, focusing on the identification and mitigation of workplace hazards faced by sewage workers. This framework may encompass principles from models such as the Hierarchy of Controls, which prioritizes measures to eliminate or reduce risks at their source. Additionally, communication theories such as the Communication Accommodation Theory could inform the design of effective communication strategies within the monitoring system, considering the diverse linguistic and cultural backgrounds of sewage workers. Moreover, Human-Computer Interaction (HCI) theories would guide the development of user-friendly interfaces and intuitive interaction designs for the monitoring system, ensuring ease of use and acceptance among workers. Furthermore, sociotechnical systems theory could be applied to understand the complex interactions between technological components, organizational structures, and human factors within sewage work environments. By integrating these theoretical perspectives, the project aims to develop a holistic framework for enhancing the safety and well-being of sewage workers through advanced monitoring and communication technologies.

Consumer Price Index (CPI) is used as a proxy in this study for inflation rate. CPI is a wide basic measure to computeusualvariation in prices of goods and services throughout a particular time period. It is assumed that arise in inflation is inversely associated to security prices because Inflation is at lastturned into nominal interest rate andchange in nominal interest rates caused change in discount rate so discount rate increase due to increase in inflation rate and increase in discount rateleads todecreasethe cash flow's present value (Jecheche, 2010). The purchasing power of money decreased due to inflation, and due to which the investors demand high rate of return, and the prices decreased with increase in required rate of return (Iqbal et al, 2010).

I. RESEARCH METHODOLOGY:

The methodology for the Smart Safety Monitoring System for Sewage Workers with Two-Way Communication project involves a systematic approach to research and development, encompassing several key steps:

1. Problem Identification and Literature Review: Begin by clearly defining the safety concerns faced by sewage workers and conducting a thorough review of existing literature on similar safety monitoring systems, communication technologies, and occupational health and safety issues in sewage work environments.

2. Research Design: Determine the appropriate research design, which may include a combination of qualitative and quantitative methods. Consider factors such as data collection techniques, sample size, and research duration.

3. Data Collection: Collect relevant data through various methods such as surveys, interviews, field observations, and technical assessments. Gather information on sewage worker tasks, safety incidents, communication needs, technological requirements, and user preferences.

4. System Design and Development: Collaborate with engineers, technicians, and software developers to design and develop the Smart Safety Monitoring System. This involves integrating sensors for monitoring environmental conditions, wearable devices for tracking worker health and location, communication modules for two-way communication, and a central monitoring platform for data analysis.

5. Prototype Testing: Conduct preliminary testing of the prototype system in controlled laboratory settings or simulated field environments to evaluate its functionality, usability, and effectiveness in addressing safety concerns.

6. Field Trials: Implement the prototype system in real-world sewage work environments and conduct field trials to assess its performance under actual working conditions. Gather feedback from sewage workers and supervisors to identify any issues or improvements needed.

7. Data Analysis: Analyze the collected data using appropriate statistical techniques to derive insights into sewage worker safety, communication patterns, system reliability, and user satisfaction. Descriptive statistics, inferential statistics, and qualitative analysis methods may be used.

8. Documentation and Reporting: Document the methodology, findings, and recommendations in a comprehensive research report or academic paper. Disseminate the results through publications, presentations, and stakeholder engagements to contribute to the body of knowledge and facilitate wider adoption of the developed system.

Throughout the methodology, it's important to adhere to ethical guidelines, ensure participant safety and privacy, and collaborate closely with relevant stakeholders such as sewage workers, industry experts, government agencies, and technology providers.

System Architecture Block Diagrams And Use Case Diagram:

The system architecture gives a high-level overview of the functions and responsibilities of the system. It defines the breakdown of the system into various sub system and the individual roles played by them. The system architecture of the proposed system is shown below in Fig.1.

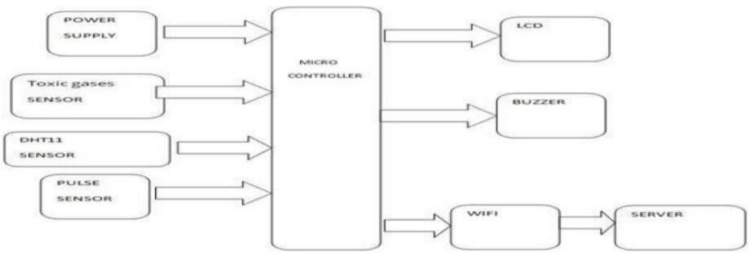


Fig.1 System Architecture

A data flow diagram (DFD) maps out the flow of information for any process or system. It uses defined symbols like rectangular or circular shapes and arrows, plus short text labels, to show data inputs,outputs, storage points and the routes between each destination. A data-flow diagram (DFD) is a graphical representation of the flow of data through an information system. DFDs can also be used for the visualization of data processing (structured design). On a DFD, data items flow from an external data source or an internal data store to an internal data store or an external data sink, via an internal process.

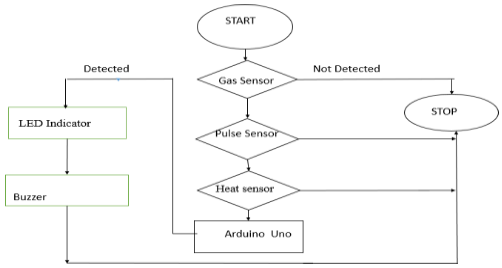


Fig.2 Block diagram

Use case diagram is a graphic depiction of the interactions among the elements of a system. Usecases will specify the expected behavior, and the exact method of making it happen. Use cases once specified can be denoted both textual and visual representation. The use case diagram for the proposed system is shown below in fig. 4.2

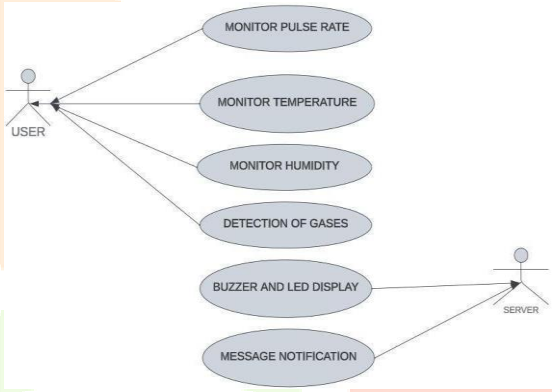


Fig.3 Use Case Diagram

HARDWARE REQUIREMENTS:

The hardware requirements include the requirements specification of the physical computer resourcesfor a system to work efficiently. The hardware requirements may serve as the basis for a contract for the implementation of the system and should therefore be a complete and consistent specification of the whole system. The Hardware Requirements are listed below:

- Gas Sensor : MQ11
- Temperature sensor : DHT11
- WiFi /Bluetooth : ESP32
- Light indicator : LED
- Sound indicator : Buzzer
- Heart rate sensor : Pulse Oximeter

SOFTWARE REQUIREMENTS:

The software requirements are description of features and functionalities of the target system. The requirements are as follows:

- Software : Proteus

IV. RESULTS AND DISCUSSION

4.1 Results of Descriptive Statics of Study Variables

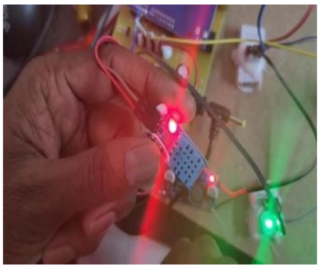
Table 4.1: Descriptive Statics

Variable	Minimum	Maximum	Mean	Std. Deviation	Jarque-Bera test	Sig
KSE-100 Index	-0.11	0.14	0.020	0.047	5.558	0.062
Inflation	-0.01	0.02	0.007	0.008	1.345	0.510
Exchange rate	-0.07	0.04	0.003	0.013	1.517	0.467
Oil Prices	-0.24	0.11	0.041	0.060	2.474	0.290
Interest rate	-0.13	0.05	0.047	0.029	1.745	0.418

Table 4.1 displayed mean, standard deviation, maximum minimum and jarque-bera test and its p value of the macroeconomic variables of the study. The descriptive statistics indicated that the mean values of variables (index, INF, EX, OilP and INT) were 0.020, 0.007, 0.003, 0.041 and 0.047 respectively. The maximum values of the variables between the study periods were 0.14, 0.02, 0.04, 0.41, 0.11 and 0.05 for the KSE- 100 Index, inflation, exchange rate, oil prices and interest rate.
The standard deviations for each variable indicated that data were widely spread around their respective means. Column 6 in table 4.1 shows jarque bera test which is used to checkthe normality of data. The hypotheses of the normal distribution are given;

H0 :The data is normally distributed.
H1 :The data is not normally distributed.

Table 4.1 shows that at 5 % level of confidence, the null hypothesis of normality cannot be rejected. KSE-100 index and macroeconomic variables inflation, exchange rate, oil prices and interest rate are normally distributed.
The descriptive statistics from Table 4.1 showed that the values were normally distributed about their mean and variance. This indicated that aggregate stock prices on the KSE and the macroeconomic factors, inflation rate, oil prices, exchange rate, and interest rate are all not too much sensitive to periodic changes and speculation. To interpret, this study found that an individual investor could not earn higher rate of profit from the KSE. Additionally, individual investors and corporations could not earn higher profits and interest rates from the economy and foreign companies could not earn considerably higher returns in terms of exchange rat e. The investor could only earn a normal profit from KSE.


IV. ACKNOWLEDGMENT:

Special thanks to the diligent efforts of our dedicated team in developing the Smart Safety Monitoring System for Sewage Workers with Two-Way Communication. We extend our gratitude to all the individuals who contributed their expertise, insights, and unwavering support throughout the project. This innovative solution aims to enhance the safety and well-being of sewage workers, and we are proud to bring it to fruition. Together, we strive to make meaningful advancements in technology for the betterment of our communities.

REFERENCES:

1. Augustine Onubeze, "Developing a Wireless Heart Rate Monitor with MAX30100 and nRF51822", BE Thesis, Helsinki Metropolia University of Applied Sciences, p.p. October 2016.

2. Arduino, Web article on different types of Arduino Board and its features, https://www.arduino.cc/, (Accessed on 10th January 2019).

3. Vivek Kumar Pandey, Sparsh Kumar, Vimal Kumar, Pankaj Goel, A Review Paper on I2C Communication Protocol, International Journal of Advance Research, Ideas and Innovations in Technology, Volume: 4, Issue 2, pp 340-343, 2018.

4. Hanwei Electronics, Data Report on Technical Data MQ-4 Gas Sensor, https://www.sparkfun.com/datasheets/Sensors/Biometric/MQ-

5. Winson, Web article on Different gas sensors, https://www.winsen- sensor.com (Accessed on 11th January 2019)

6. Occupational Safety and Health Administration, United States of Department of Labor, a web article of exposure and quantity of methane, https://www.osha.gov/ (Accessed on 11th January 2019).