



## Assignment Cover Sheet

Assignment Title:	Digital Gas Cylinder Meters:Enhancing Safety through Early Explosion Detection		
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# Digital Gas Cylinder Meters: Enhancing Safety through Early Explosion Detection

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**Abstract—** This study explores the impact of digital gas cylinder meters on the early detection of explosions caused by gas leaks. The objective was to assess the effectiveness of these meters in enhancing safety measures and incident prevention. Through advanced sensor technologies and real-time data monitoring, digital gas cylinder meters enabled prompt detection and analysis of gas leakages. This study underscores the significance of these meters in improving safety standards within industrial and residential settings. The findings highlight the utility and importance of digital gas cylinder meters in advancing safety protocols. Their ability to continuously monitor gas levels and provide immediate alerts upon detecting anomalies significantly improves response times and reduces explosion risks. This study contributes to the field by demonstrating how these technologies enhance early detection capabilities, ultimately elevating safety standards and setting new benchmarks for gas leak prevention in various operational environments.

**Index terms—** Gas explosion, digital gas meters, real-time monitoring, remote monitoring

## I. INTRODUCTION

### A. Background information:

In recent years, Bangladesh has witnessed several incidents of gas cylinder explosions across various industries and residential areas. Gas wastage due to carelessness, coupled with inadequate infrastructure and awareness, poses a constant threat to public safety. The recent incidents, such as the devastating fire on Bailey Road in which almost 44 people died and more than 22 people were hospitalized in serious condition, underscore the urgent need for preventive measures [1]. In Narayanganj alone, several incidents of gas explosions have been recorded during the past years [2]. These incidents demand immediate attention to implement effective safety protocols and technologies, such as digital gas cylinder meters, to mitigate risks and ensure early detection of potential explosions.

### B. Overview:

Digital gas meters offer a promising solution to mitigate the risk of gas cylinder explosions. These meters continuously monitor parameters like pressure, temperature, and gas flow rates,

providing real-time data for early detection of anomalies. By enabling automated monitoring and alert systems, digital meters facilitate timely intervention to prevent accidents. Additionally, data logging capabilities allow for comprehensive analysis of gas cylinder performance, informing predictive maintenance schedules and enhancing safety management practices. Advancements such as robotic systems equipped with gas sensors aim to replace manual detection methods, enhancing worker safety by remotely monitoring confined spaces for explosive or flammable gases [3]. Implementing digital gas meters in Bangladesh can significantly improve safety outcomes by enhancing early detection capabilities and enabling proactive safety measures.

## II. METHODOLOGY

### A. Description of the Solution:

The solution involves implementing digital gas cylinder meters equipped with sensors and communication capabilities to enhance safety measures regarding gas cylinder explosions. This device is employed with a microcontroller integrated with a gas sensor, GSM module, LCD display, and buzzer for gas leakage monitoring and alerting via SMS [4]. These digital meters are designed to monitor gas levels in real-time, detecting abnormalities such as sudden pressure changes or gas leaks. By retrofitting existing cylinders or integrating digital meters into new ones, a centralized monitoring system can be established to facilitate early detection and prevention of potential hazards.

### B. Methods Used:

To investigate the efficacy of digital gas cylinder meters in enhancing safety measures, a questionnaire-based survey was conducted. Utilizing Google Forms, a comprehensive questionnaire comprising 11 questions was developed and distributed to the participants. The survey aimed to gather insights into their perceptions and experiences regarding the use and benefits of digital gas cylinder meters in enhancing safety measures and preventing explosions which helped to understand if digital meters would be helpful to prevent gas cylinder explosions

### C. Selection of Contributors:

A mixed group of people were selected as participants for the

survey who are familiar with technology and their potential role in advocating for safety measures. This demographic was chosen for their accessibility and quick response on online platforms. The survey sought to capture diverse perspectives and experiences related to the implementation of digital gas cylinder meters, ensuring a comprehensive understanding of their impact on safety measures and explosion prevention. A total of 29 participants' feedback were considered, providing valuable insights into the effectiveness of digital metering technologies in enhancing safety.

### III. RESULTS AND DISCUSSION

#### A. Analytical Result:

It can be observed from figure 1 that most of the people have either witnessed or experienced gas explosion.

29 responses

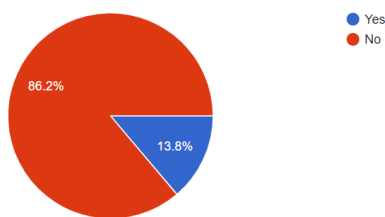


Fig 1. Number of people who have witnessed or experienced gas explosion

Figure 2 indicates how familiar people are with digital gas cylinder meters and their role in enhancing safety measures. It can be seen from the figure that most of the people are somewhat familiar about it.

29 responses

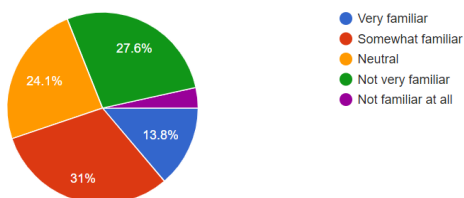


Fig 2. Familiarity of people about digital gas cylinder meters

Figure 3 illustrates that almost half of the people strongly support the implementation of digital gas cylinder meters in their workplace or community. No one oppose or strongly oppose the implementation.

29 responses

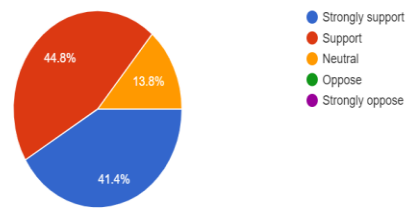


Fig 3. Number of people who support the implementation of digital gas cylinder meters.

It can be seen from Figure 4 that more than half of the people believe that real-time monitoring of gas levels would be preventing gas cylinder explosions.

29 responses

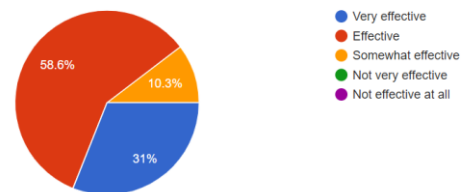


Fig 4. Effectiveness of real-time monitoring of gas levels

Figure 5 shows that most of the people would like to invest in digital metering technologies for gas cylinder safety.

29 responses

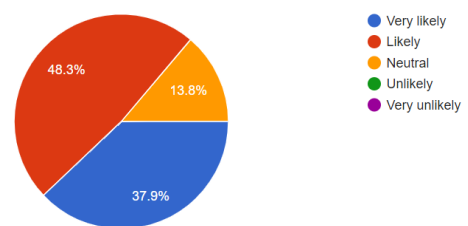


Fig 5. How likely people are to invest in digital gas cylinder meters.

#### B. Discussion:

From the data in the result section, it can be said that the implementation of digital metering technology is going to reduce the risk of gas cylinder explosions. One of the major findings is that 83.2 percent of people have either experienced or witnessed gas explosions. If the real-time monitoring of gas cylinders can be done, then it can prevent the risk of gas cylinder explosions. For gas cylinder safety, more than 85 percent of the people are likely to invest in digital metering system and the rest of the people are neutral about it.

By analyzing the pie charts, it can be clearly seen that most of the respondents agreed on the implementation of digital gas cylinder meters. If this can be implemented, the risk of gas cylinder explosion could be reduced.

#### IV. CONCLUSION

This research has demonstrated the significant impact of digital gas cylinder meters on improving early detection of explosions in industrial settings, addressing the critical problem outlined in the introduction. Key findings emphasize the effectiveness of digital meters in enhancing safety protocols by enabling continuous monitoring of critical parameters. Benefits include improved safety outcomes, although challenges like implementation costs remain. Future research should focus on optimizing sensor technologies and integrating advanced analytics for predictive risk assessment.

##### A. Limitations:

While this research successfully demonstrated the effectiveness of digital gas cylinder meters in enhancing early detection of explosions, limitations include initial implementation costs and ongoing maintenance requirements. These challenges may hinder widespread adoption in industrial settings, necessitating further research to optimize cost-effectiveness and scalability of digital metering technologies.

##### B. Suggestions:

Future research should focus on refining sensor technologies, integrating data analytics for predictive modeling, and conducting comprehensive cost-benefit analyses to optimize the adoption of digital gas cylinder meters and further enhance safety in industrial environments.

#### ACKNOWLEDGEMENT

We would like to express our sincere gratitude to all those who have contributed to the completion of this research paper. Firstly, we extend our heartfelt appreciation to our course instructor Shibaji Mridha, Assistant Professor of AIUB for his guidance. His invaluable assistance has significantly enhanced the quality of this work. We are also thankful to everyone who has taken part in the survey. Their contributions have played major role in the completion of this research.

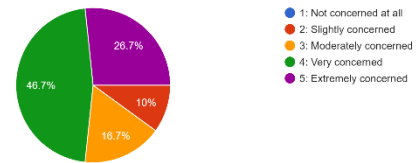
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- [3] M. A. Abu Bakar and M. R. Manan, "System Design for Early Detection of Explosive and Flammable Gas Leaks," *Journal of Physics Conference Series*, vol. 2107, no. 1, p. 012028, Nov. 2021, doi: 10.1088/1742-6596/2107/1/012028. [Online]. Available: <https://doi.org/10.1088/1742-6596/2107/1/012028>

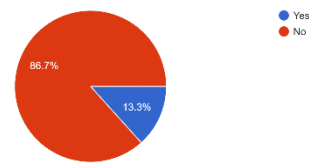
- [4] Y. Nureni, O. Adigun, A. Oloyede, and O. Akinade, "Gas Leakage Detector and Monitoring System," *International Journal of Engineering and Manufacturing*, vol. 12, no. 4, June 2022. [Online]. Available: <https://doi.org/10.5815/ijem.2022.05.05>

#### APPENDIX

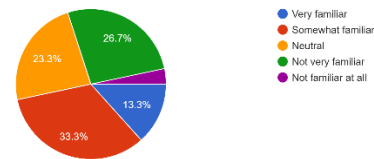
1. On a scale of 1 to 5, how concerned are you about the risks associated with gas cylinder explosions?  
30 responses



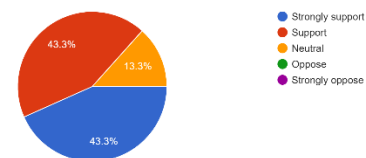
2. Have you ever experienced or witnessed a gas cylinder explosion incident?  
30 responses



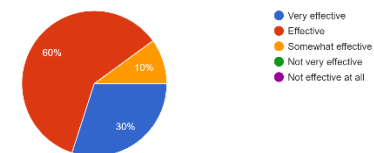
3. How familiar are you with digital gas cylinder meters and their role in enhancing safety measures?  
30 responses



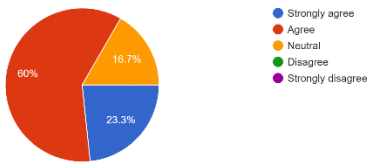
4. Would you support the implementation of digital gas cylinder meters in your workplace or community?  
30 responses



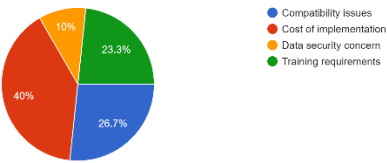
5. How effective do you believe real-time monitoring of gas levels would be in preventing gas cylinder explosions?  
30 responses



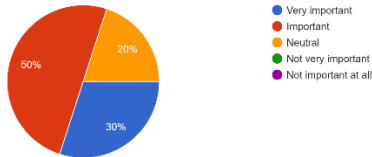
6.To what extent do you agree that data analytics from digital gas cylinder meters could improve safety measures?  
30 responses



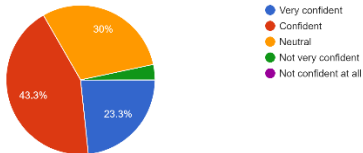
9.What are your main concerns regarding the integration of digital gas cylinder meters into existing infrastructure?  
30 responses



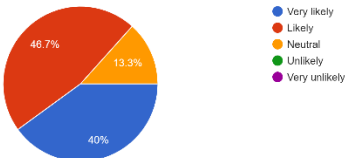
7.How important do you think remote monitoring of gas cylinders is for enhancing safety measures?  
30 responses



10.How confident are you in the security measures implemented to protect the data transmitted from digital gas cylinder meters?  
30 responses



8. How likely are you to invest in digital metering technologies for gas cylinder safety?  
30 responses



10.How confident are you in the security measures implemented to protect the data transmitted from digital gas cylinder meters?  
30 responses

