© MAY 2026 | IRE Journals | Volume 9 Issue 11 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I11-1717759

Development of a Vehicle Emission Monitoring Framework for Environmental Control utilizing AI Techniques

FORAM PATEL[1], DR D GANESH[2]
[1]Scholar (MSC CS & IT), Department of Computer Science & IT, Jain (Deemed-To-Be-University), Bangaluru, India
[2]Professor, Department of Computer Science & IT, Jain (Deemed-To-Be-University), Bangaluru, India

Abstract- ***The world is facing issues due to urbanization and industrialization. Urbanization and industrialization are causing a lot of carbon to be released into the air. This is really bad, for the environment. The environment is getting polluted because of urbanization and industrialization. Also urbanization and industrialization are making people need energy. The new technologies used in cities, such as Artificial Intelligence, Internet of Things, blockchain and deep learning are really good at monitoring the environment and reducing the amount of emissions. Many people have done research. Suggested using intelligent systems to control traffic manage energy monitor the emissions from vehicles check the air quality and manage renewable energy .Some studies have shown that machine learning algorithms, like Deep Q-Learning, Random Forest and Convolutional Neural Network can be used to process data about the environment and make monitoring more effective. Internet of Things-based sensors are also used to collect data in time from transportation networks, energy stations and environmental monitoring stations. However most of the solutions that're available only focus on one area of the environment and do not provide a complete framework to check and assess many environmental parameters at the same time. Some of the suggested systems can only be used in experiments or on a small scale. This paper reviews fifteen research studies on Artificial Intelligence-based emission monitoring, smart grid energy management, air quality prediction and blockchain-based mechanisms of tracking carbon emissions. The research also finds some gaps in the current research and suggests implementing a system that combines Artificial Intelligence and Internet of Things to facilitate sustainable monitoring of carbon emissions in smart cities. The research on Artificial Intelligence and Internet of Things can help make the monitoring of carbon emissions more sustainable, in cities.***

Keywords - Smart Cities are really important to me, I am also interested in Carbon Emission Monitoring because it is good, for the environment, Artificial Intelligence is something that I think can help us a lot, Internet of Things is another thing that I like because it connects lots of devices, Smart Grid is a way to save energy, Deep Learning is a part of Artificial Intelligence that I think is really cool, Environmental Monitoring is very important to keep our planet clean and that is why I like Smart Cities and Environmental Monitoring and Carbon Emission Monitoring and Artificial Intelligence and Internet of Things and Smart Grid and Deep Learning.

I. INTRODUCTION

Background of the Study

Environmental pollution and carbon emissions are global challenges that have the potential to change the climate, endanger lives by causing illnesses, and adversely impact the environment. Various actions including commuting from one place to another in our cities and manufacturing products within our factories increase environmental pollution and carbon emissions. More people will be moving into urban areas in the near future; thus, there is a need to ensure that we manage our environment effectively. We need to monitor environmental pollution and carbon emissions and make the best possible decisions regarding their management. By applying technologies such as artificial intelligence and internet of things, we could develop smart systems capable of monitoring environmental pollution and carbon emissions as well as managing them.

Environmental pollution and carbon emissions are issues that we need to deal with. We need to use technology to help us with environmental pollution and carbon emissions. These systems can collect information about the environment analyze it and

help us manage things better. Many cities are trying to use technology to reduce pollution and be more friendly, to the environment. They are using Artificial Intelligence to control traffic monitor the air quality and manage energy use to reduce pollution and carbon emissions. They are also using energy sources to reduce carbon emissions and make the environment cleaner and healthier for everyone. Environmental pollution and carbon emissions are still problems but with new technology we can make the environment better.

Problem Statement

We have lots of technologies to monitor things. Most of these technologies work alone and only look at one thing like the air or the traffic. For example some systems only look at the things that cars put into the air while others only look at how to make the power grid work better or predict how clean the air will be.

This is a problem because we cannot get a picture of what is going on. We need a system that can put all of these environmental monitoring systems together using technologies like artificial intelligence. This will help us reduce the things we put into the air in our cities. We need a monitoring framework that can combine multiple environmental monitoring systems like the ones that monitor air quality, traffic emission and smart grid management to reduce carbon emissions in smart cities and that is what environmental monitoring systems, like these can do for our cities.

Motivation

There have been more serious consequences of climate change. There have been more problems in the environment due to climate change. Therefore, it is necessary to analyze the state of the environment to make any improvements towards improving the environment. Climate change remains a problem. The environment remains another problem. There are different things that could be done for dealing with climate change. In other words, one can examine climate change and the environment for making any changes or improvements towards improvement of the environment. In the end, climate change and the environment remain two issues that require solutions through taking measures towards dealing with both issues.

There are technologies that may assist in solving problems related to climate change and the environment. Such technologies include AI and IoT. If we use these technologies in our city we can do a job of watching what is happening to the environment. We can also find ways to use energy that's better, for the environment and reduce the bad things we release into the air. Climate change and environmental degradation are the reasons we need to do all of this to help the environment.

Objectives of the Study

The main goals of this research are:

- To look at studies on AI and IoT-based systems that monitor emissions.
- To examine machine learning and deep learning methods used for environmental monitoring.
- To find gaps in monitoring systems.
- To suggest a framework for monitoring carbon emissions that brings everything together.

The main goals of this research are:

- To review studies on AI and IoT-based emission monitoring systems.
- We want to check out machine learning and deep learning techniques used in environmental monitoring.
- The goal is also to identify gaps, in emission monitoring systems.
- To propose a conceptual framework that integrates carbon emission monitoring.

Contributions of the Paper

This paper does the following things:

- It looks at recent studies about using Artificial Intelligence to monitor the environment.
- Artificial Intelligence is used to see how it can help with this.
- It compares technologies like Artificial Intelligence, Internet of Things, blockchain and smart grid infrastructures to see what works best.
- The Internet of Things and Artificial Intelligence are compared to technologies.
- It finds the problems in the way we currently monitor emissions.
- Emission monitoring solutions are looked at to see what is missing.

- It suggests a way to monitor the environment using Artificial Intelligence and the Internet of Things that would be good, for smart cities.
- The Artificial Intelligence and Internet of Things framework is proposed for cities.

Organization of the Paper

The rest of this paper is set up in the way:

- The literature review of existing research studies is, in Section 5.
- Section 6 is where the proposed methodology and system framework are explained.
- We talk about what we expect to happen and how we will evaluate the system in Section 7.
- The proposed system has a lot of applications which are described in Section 8.
- Finally Section 9 is the conclusion of the proposed system. It also talks about what we can research in the future about the proposed system.

Related Work / Literature Review

- Ashokkumar et al. (2024) designed an AI-based adaptive traffic signal control system using AI and Deep Q-Learning technologies, aiming to reduce traffic delays and greenhouse gas emissions.
- Muleta et al. (2021) discussed the application of IoT in smart grid Energy Management Systems and showed its capability to improve monitoring and efficiency.
- Diwakaran et al. (2025) developed an IoT based smart vehicular emission monitoring system that uses Random Forest algorithm for real time emission classification and detection.
- Han et al. (2016) created an AIS based vessel emission monitoring system that accurately tracked vessel movement and marine emission estimates.
- Fang et al. (2024) proposed an AIoT based carbon accounting and monitoring system which is capable of enhancing carbon emission monitoring precision at educational organizations.
- Rauniyar et al. (2020) designed NEMO which is a smart city system using IoT sensors and AI models for efficient monitoring of vehicle noise and emission.
- Phayomhom et al. (2019) proposed a roadmap for the design of smart grids that would help the development of the system on smart grid technologies.
- Araneo et al. (2025) introduced the MESSI smart island energy management system which aims at efficiently optimizing energy management at islands using AI, battery storage and demand-side management techniques.
- Koval et al. (2019) designed a smart grid synchronization monitoring framework that enhances the system's performance using smart grid monitoring technologies.
- Rao et al. (2025) presented a Blockchain-IoT carbon credit management framework which aims to prevent the system from fraud by using the blockchain and IoT technologies for tracking carbon credits.
- Jyoti et al. (2025) reviewed the various AI models designed for predicting EV charging such as Deep learning and LSTM.
- Bento et al. (2024) designed a smart parking system with IoT and AI dashboards, aimed at reducing the time spent by vehicles searching for parking spots and thus reducing its emissions.
- John et al. (2025) developed an edge computing and CNN based real time air quality monitoring system that works through embedded devices.
- Saidi et al. (2024) developed a UAV-IoT-deep learning based solar panel fault detection system which can improve the solar panel monitoring performance.
- Feng et al. (2023) presented an industrial carbon emission monitoring system which is able to increase industrial emission monitoring transparency and accuracy with the help of the blockchain technology.

Critical Review

Although earlier studies show that Artificial Intelligence and Internet of Things can help with monitoring there are still some problems. Many of the proposed systems are only tested in controlled environments not in real-life situations. Some solutions require setups like drones or complex computer networks, which can be expensive to set up. Another issue is that most studies focus on one problem at a time like reducing transportation

emissions or improving air quality. There are no systems that can combine environmental monitoring systems.

Artificial Intelligence and Internet of Things technologies can help with monitoring. We need better solutions. Environmental monitoring systems should work together to give us a picture. We still need to work on creating frameworks, for monitoring. Artificial Intelligence and Internet of Things can make monitoring better if used correctly. We need to improve the way we monitor the environment.

Identified Research Gaps

When we look at what people have written about this topic we find some problems that need to be solved.
These problems are:

- We do not have systems that can watch and connect traffic, energy and air quality information at the same time.
- We have not tried out these systems in the world enough to see if they can be used on a large scale.
- To have monitoring systems we need a lot of infrastructure which can be a big problem.
- We are not using intelligence, internet of things and blockchain technologies together in one system, which is a big research gap, in artificial intelligence internet of things and blockchain technologies.

Proposed Methodology

System Overview

When people write about this topic they mention some issues that need to be fixed.
These issues are:

- We don't have systems that can track traffic, energy and air quality at the time.
- These systems haven't been tested enough in life to know if they can be used widely.
- To have monitoring systems we need a lot of infrastructure, which is a big challenge.
- We are not combining intelligence, internet of things and blockchain technologies in one system. This is a gap in research, on artificial intelligence, internet of things and blockchain technologies.

Workflow

The system workflow consists of the following stages:

1. Collection of environmental data using IoT sensors and monitoring devices.
2. Data preprocessing and storage in cloud-based databases.
3. Application of machine learning models to analyze emission patterns.
4. Generation of optimization strategies using intelligent decision-making systems.
5. Visualization of results through dashboards for city administrators and decision-makers.

Dataset Description

The proposed framework is going to use different datasets, including:

- Traffic flow datasets
- Air quality monitoring datasets
- Smart grid energy consumption datasets
- Vehicle emission datasets

These Traffic flow datasets and Air quality monitoring datasets and Smart grid energy consumption datasets and Vehicle emission datasets help us do a complete analysis of the environment in many different areas.

Expected Results and Discussion

The new system is going to help us keep an eye on the environment and reduce the amount of carbon we put out.

The new system will do this by looking closely at the data we have.

Potential outcomes include:

- We will be better at finding the patterns of the stuff we put in the air
- We will make energy systems that work a lot better
- There will be traffic in cities
- We will have an idea of how clean or dirty the air is.

Applications and Use Cases

The new system can be used in different areas including:

- Watching the environment in a smart city.
- Controlling the things that cars send into the air in cities.
- Managing energy in a smart grid.
- Keeping track of renewable energy systems.
- Tracking the things that factories send into the air, which is industrial carbon emission tracking or, in other words the new system can be used for industrial carbon emission tracking like the system can be used for tracking the bad things that factories send into the air.

Conclusion

This paper looked at fifteen studies on environmental monitoring systems that use AI, IoT and blockchain. The analysis found methods used to reduce traffic emissions monitor smart grids, forecast air quality and manage renewable energy. We see that there have been advancements in these technologies. Most current solutions are separate and do not have a combined monitoring platform. The suggested AI-IoT framework will address these issues.

It will help us understand the environment globally and make decisions in city settings. Future research should focus on implementing these technologies on a scale, in real-world situations. It should also improve how multiple monitoring systems work together within city infrastructures.