

# Smart Road Condition Monitoring Using IoT and Artificial Intelligence

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## 1. Title

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## 2. Abstract

Road infrastructure is a vital component of transportation systems, directly influencing safety and economic development. Traditional road inspection methods rely on manual surveys, which are time-consuming and prone to inaccuracies. This paper proposes an IoT and Artificial Intelligence based road condition monitoring system that enables real-time data collection, accurate defect detection, and predictive analysis to improve road safety and maintenance efficiency.

## 3. Introduction

Rapid urbanisation and increased vehicle usage have placed considerable pressure on road infrastructure. Poor road conditions result in traffic congestion, vehicle damage, and accidents. IoT sensors and AI algorithms provide an automated and scalable solution for continuous road condition monitoring.

## 4. Literature Review

Several studies have explored IoT-based sensing and machine learning approaches for road condition monitoring. Accelerometer-based systems and machine learning models such as SVMs and neural networks have shown promising results. However, many existing systems lack real-time prediction and integrated AI analytics.

## 5. Research Methodology

### a. Research Design

Descriptive and experimental research design using IoT sensors and AI algorithms.

### b. Hypotheses

$H_0$ : IoT and AI-based systems do not significantly improve detection accuracy.

$H_1$ : IoT and AI-based systems significantly improve detection accuracy.

### c. Sampling Method

Purposive sampling of urban, semi-urban, and highway road segments.

### d. Procedure

- Sensor installation
- Data collection
- Cloud transmission
- Data preprocessing
- AI-based classification
- Performance evaluation

### e. Sample Size

Data collected from 50–100 road segments.

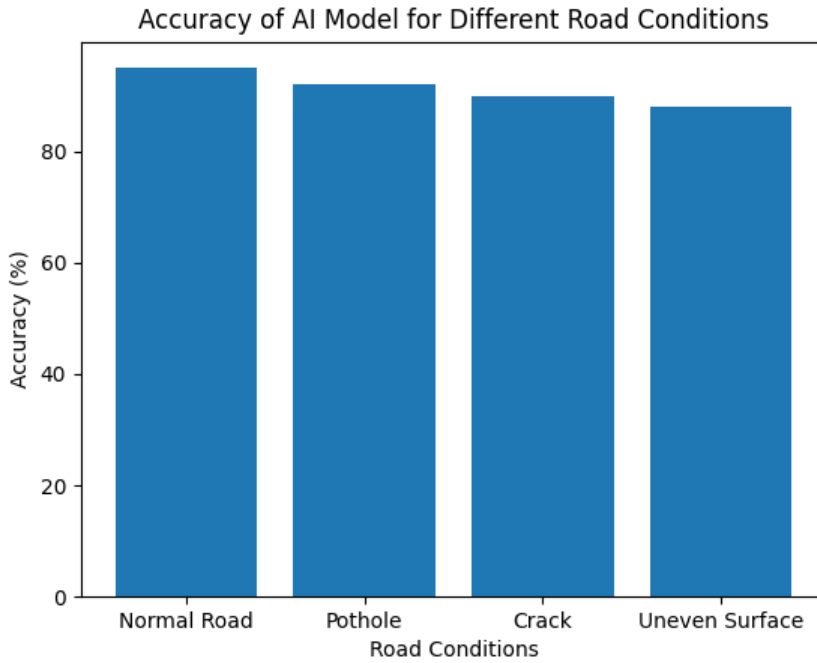
## 6. Primary Data Presentation

### a. Data Tables

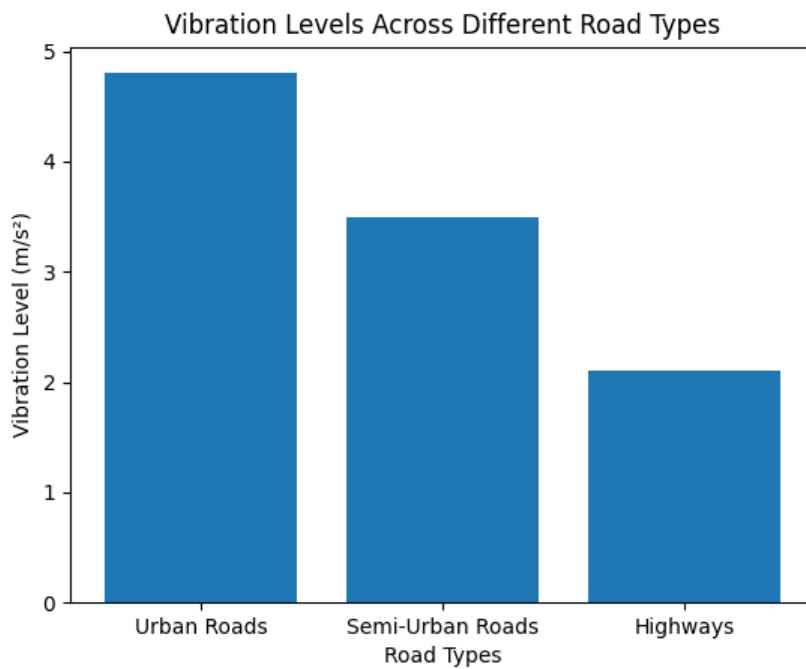
(Primary data tables can be included here.)

### b. Graphs

Graph 1: Accuracy of AI Model for Different Road Conditions



Graph 2: Vibration Levels Across Different Road Types



### 7. Hypothesis Testing

The proposed system shows higher accuracy than traditional inspection methods. Hence,  $H_0$  is rejected and  $H_1$  is accepted.

### 8. Findings

- Real-time road defect detection
- Improved accuracy using AI
- Early deterioration prediction
- Enhanced road safety

## 9. Suggestions

- Adoption of IoT-based systems by authorities
- Smart city integration
- Use of deep learning models
- Crowdsourced data utilization

## 10. References

Mohan, P., et al., ACM SenSys, 2008.

Eriksson, J., et al., ACM MobiSys, 2008.

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