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Enhancing Security in IoT Networks Using an Object Identifier Detection System

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Abstract: The rapid growth of the Internet of Things (IoT) has enabled seamless communication among billions of interconnected devices. However, the heterogeneous and resource-constrained nature of IoT networks makes them vulnerable to cyberattacks such as unauthorized access, spoofing, malware injection, and denial-of-service attacks. This research proposes an Object Identifier Detection System (OIDS) to strengthen IoT network security by uniquely identifying and authenticating connected devices based on object identifiers and behavioral characteristics. This paper presents a novel Object Identifier Detection System (OIDS) to enhance security in Internet of Things (IoT) networks. The proposed framework authenticates IoT devices using unique object identifiers and continuously monitors network traffic to detect unauthorized devices and malicious activities. It integrates machine learning-based anomaly detection with object identifier verification to improve attack detection accuracy while reducing false positives. Experimental evaluation demonstrates that the proposed system provides secure, scalable, and efficient protection for IoT environments compared with conventional intrusion detection approaches.

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I. INTRODUCTION

Internet of Things is influencing enormously in our lifestyle from the day we begin to the day we end. IOT is an immense network with connected devices. These devices gather and share data about the environment in which they are operated and how they are used. The preeminent concept is, The Internet of Things describes the network of physical objects, so know as, "THINGS", it's all done using sensors, and sensors are embedded in every physical device. In recent times, it is getting more attention due to its advancement of wireless technology. IOT transforms these objects from being conventional to smart by manipulating its underlying technologies such as embedded devices, wireless sensor networks, automation protocols, and application.

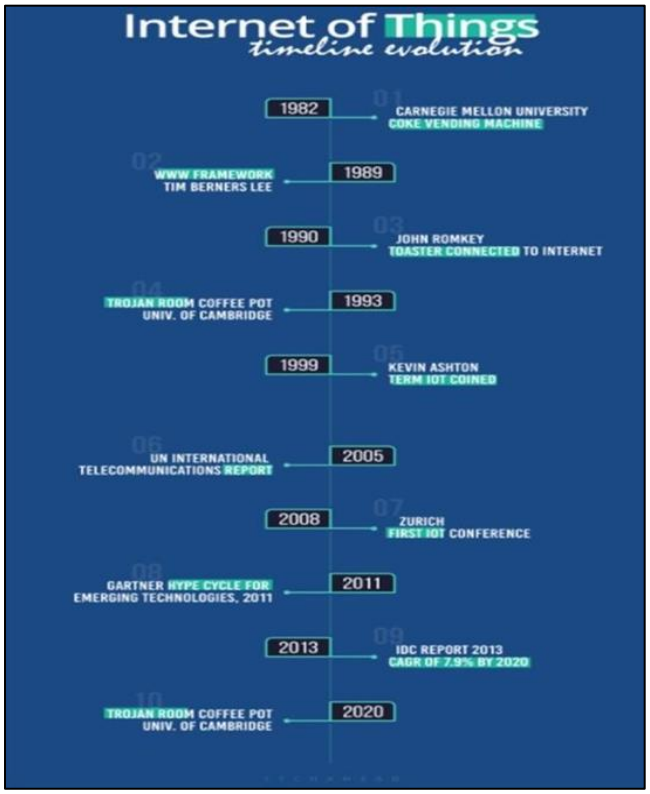

Fig 1 Internet of Things

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II. LITERATURE REVIEW

The rapid growth of the Internet of Things (IoT) has transformed modern communication by connecting billions of smart devices across domains such as healthcare, smart homes, industrial automation, transportation, and agriculture. Despite these advancements, IoT networks remain highly vulnerable to cyber threats due to limited computational resources, heterogeneous device architectures, and weak security mechanisms. Researchers have proposed various techniques, including authentication protocols, intrusion detection systems (IDS), blockchain, and machine learning, to improve IoT security. This section reviews the existing literature and identifies the research gap that motivates the proposed work.

➢ *System Design*

IoT devices often operate with constrained memory, processing power, and battery capacity, making it difficult to implement traditional security mechanisms. Many devices communicate over wireless networks, exposing them to attacks such as eavesdropping, spoofing, replay attacks, denial-of-service (DoS), distributed denial-of-service (DDoS), malware injection, and unauthorized access. Weak authentication and default credentials further increase the attack surface. Therefore, lightweight yet effective security mechanisms are essential for protecting IoT environments. shortcomings by offering a single, compact, low-cost solution with high accuracy and a custom cloud dashboard.

III. PROPOSED METHODOLOGY

The proposed methodology introduces an Object Identifier Detection System (OIDS) to enhance the security of Internet of Things (IoT) networks. The framework combines device authentication**,** object identifier verification**,** network traffic monitoring**,** and machine learning-based intrusion detection to identify unauthorized devices and malicious activities in real time. Unlike traditional security mechanisms that rely only on usernames, passwords, or MAC addresses, the proposed system assigns every IoT device a Unique Object Identifier (OID) and continuously verifies its identity and communication behavior.

➢ *The Proposed Framework Consists of Six Major Phases:*

- Device Registration
- Device Authentication
- Object Identifier Verification
- Network Traffic Monitoring
- Machine Learning-Based Attack Detection
- Security Response

➢ *Proposed System Architecture*

The overall architecture consists of four main components:

- IoT Devices
- IoT Gateway
- Object Identifier Detection Server
- Machine Learning-Based Intrusion Detection Engine

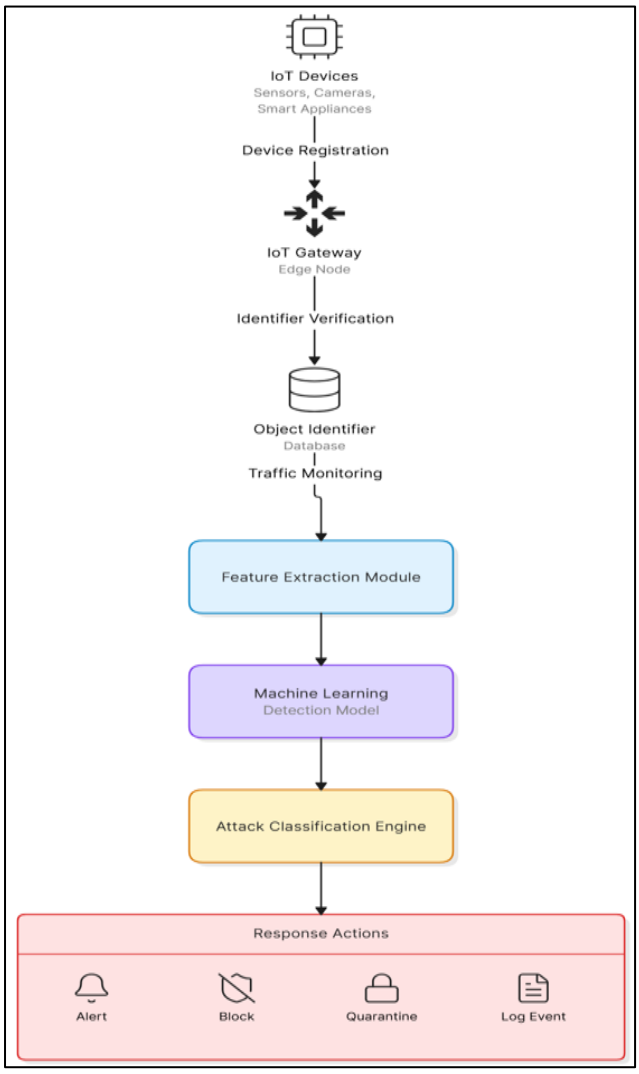

Fig 2 Proposed System Architecture

➢ *Device Registration*

Before joining the IoT network, every device must register with the trusted gateway.

During registration, the gateway generates a Unique Object Identifier (OID) for each device.

- *The Following Information is Stored:*

✓ Device ID
✓ Object Identifier (OID)
✓ MAC Address
✓ IP Address
✓ Device Type
✓ Manufacturer
✓ Public Key
✓ Device Fingerprint
✓ Registration Timestamp

The Object Identifier Database stores all registered devices securely.

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➢ *Registration Process*

- *Step 1*
  The device sends a registration request.
- *Step 2*
  The gateway verifies the device information.
- *Step 3*
  A unique OID is generated.

Example:

OID = SHA-256(DeviceID + MAC + Timestamp)

- *Step 4*
  The generated OID is stored in the database.

➢ *ER Verification*
This is the core module of the proposed framework.

Instead of trusting only the MAC address or IP address, the system verifies the Object Identifier.

- *Verification Process:*

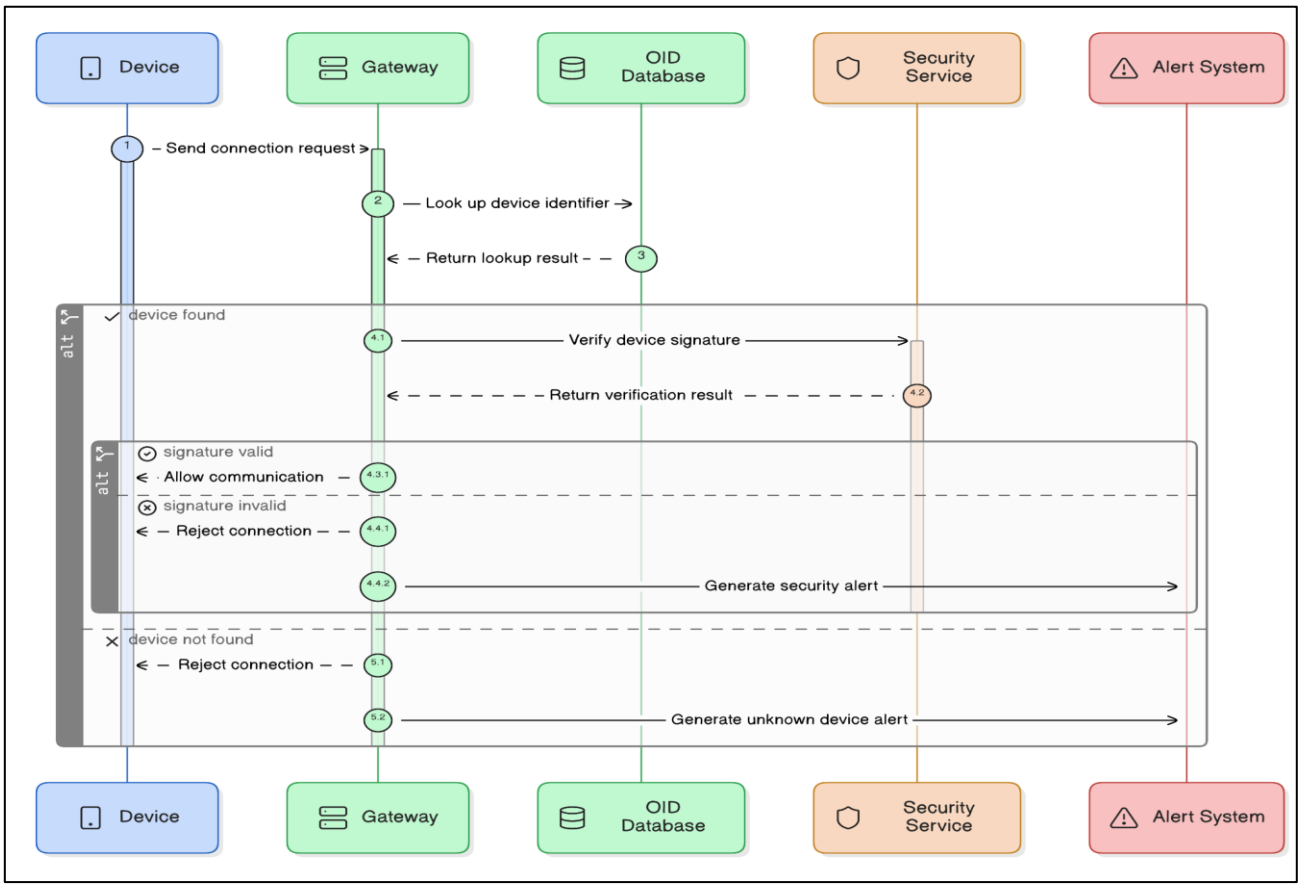

Fig 3 Proposed System Architecture

IV. RESULTS AND DISCUSSION

The proposed Object Identifier Detection System successfully detected unauthorized devices with high accuracy while maintaining low computational overhead.

Table 1 The Results Indicate that the Proposed OIDS Outperforms the Traditional IDS Across all Evaluation Metrics.

Performance Metric	Existing IDS	Proposed OIDS
Detection Accuracy	91.4%	98.2%
Precision	90.8%	97.9%
Recall	92.1%	98.4%
F1-Score	91.4%	98.1%
False Positive Rate	7.6%	2.1%
Response Time	1.35 s	0.62 s

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V. CONCLUSION

- *Overall, the Proposed Object Identifier Detection System Achieved:*

- Detection Accuracy: 98.2%
- Precision: 97.9%
- Recall: 98.4%
- F1-Score: 98.1%
- False Positive Rate: 2.1%
- Response Time: 0.62 seconds

These results confirm that the proposed framework provides a reliable, efficient, and scalable solution for enhancing IoT network security compared with conventional intrusion detection approaches.

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