Intrusion Detection in IIOT Network

Figure 1: Illustration [14]

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Introduction to IoT Networks

A network of physical devices, vehicles, home appliances, and other objects that are embedded with sensors, software, and connectivity, enabling them to collect and exchange data over the internet.

IOT ?

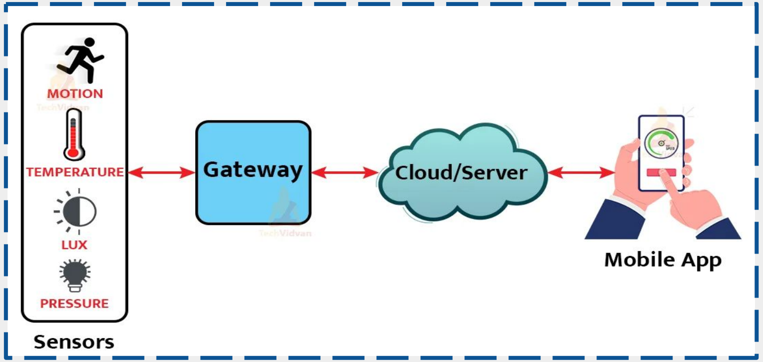


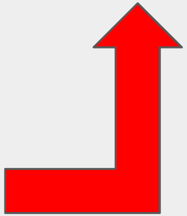
Figure 2: **IoT Network** [10]

The application of these networks ranges from Automotives, Consumer electronics, Industries, and many other Automation oriented products.

Figure 3: Illustration [11]

Figure 4: Illustration [12]

Figure 5: Illustration [13]



GROWING

Security Challenges in IoT Networks

With the scaling-up in number of devices and networks, the vulnerability towards information breach and intrusion scales-up.[8]

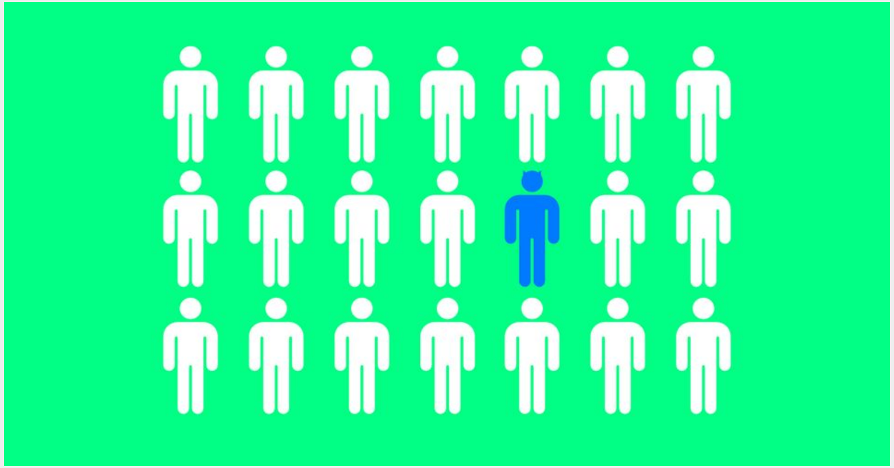


Figure 7: Illustration [17]

We'll see some of the major impacts of these security threats in the upcoming slides.

IOT Botnets

- A network of hijacked internet-connected devices that are installed with malicious codes known as malware. [1]
- Botnet consists of :
  1. Bots
  2. Botmaster

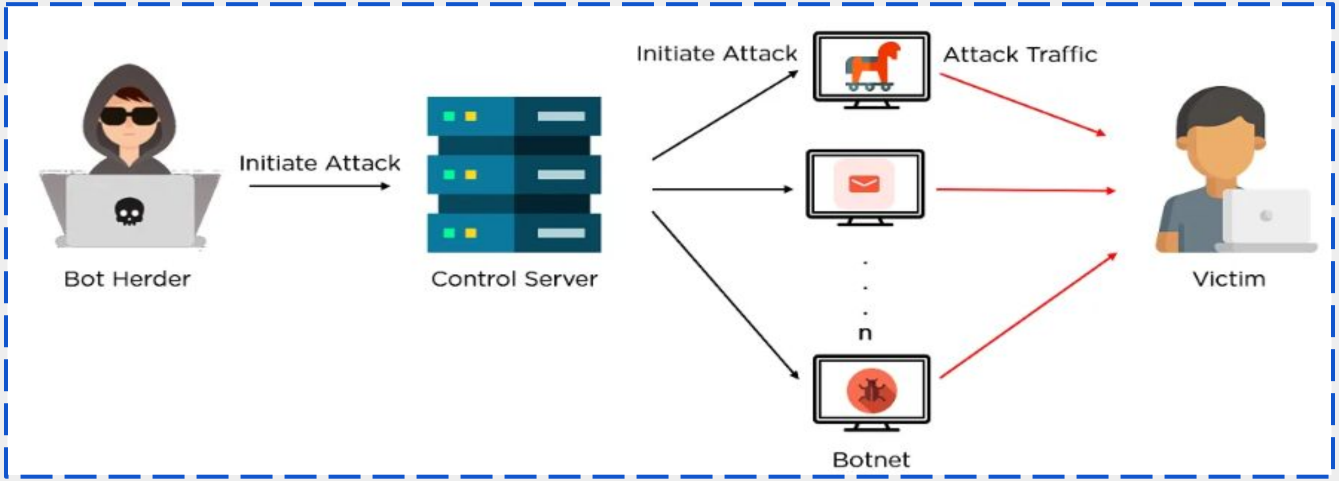


Figure 8: Working of a Botnet [1]

Examples of Impact on Businesses

The world has already experienced notable IoT botnet attacks.

Mirai botnet- CNN, Netflix, Paypal, Visa or Amazon under Dyn were attacked in 2016

- 100,000 IoT devices and reaching up to 1.2 Tbps
- websites unreachable by the legitimate users for several hours
- lost around 8% of its customers (i.e., 14000 domains)

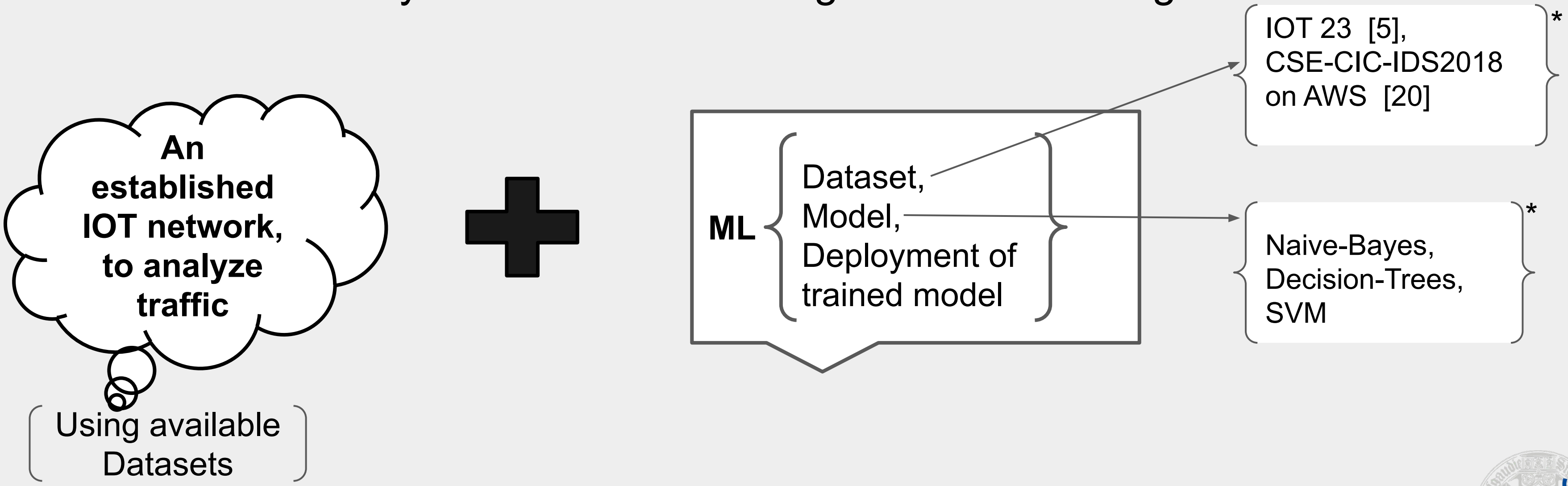
Fig. 9: Illustration [18]

Figure 10: Illustration [18]

Figure 11: Illustration [19]

Project Goals and Methods

- Detect intrusions and malicious activities in IoT networks.
- Identify botnet-generated traffic patterns.
- Enhance the security of IoT networks using machine learning models.



An established IOT network, to analyze traffic

Using available Datasets

ML Dataset, Model, Deployment of trained model

IOT 23 [5], CSE-CIC-IDS2018 on AWS [20] *

Naive-Bayes, Decision-Trees, SVM *

* probable datasets and models, which are subject to change based on evaluation-metrics.

Machine Learning for IoT Security

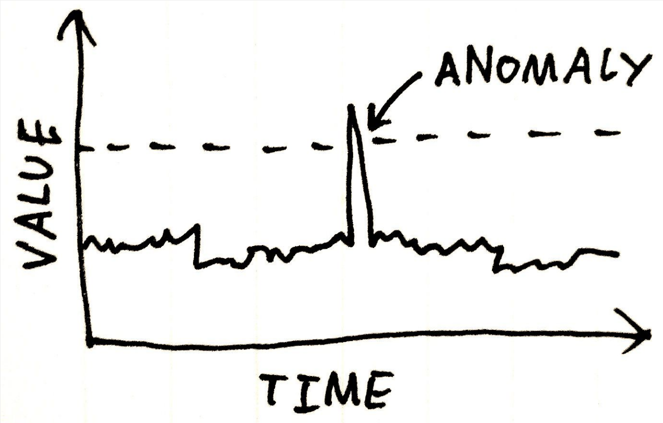


Figure 12: **Visualization of Anomaly** [16]

Anomaly Detection - Identifying unusual patterns or behavior in device data that may indicate a security breach or other problem.[16]

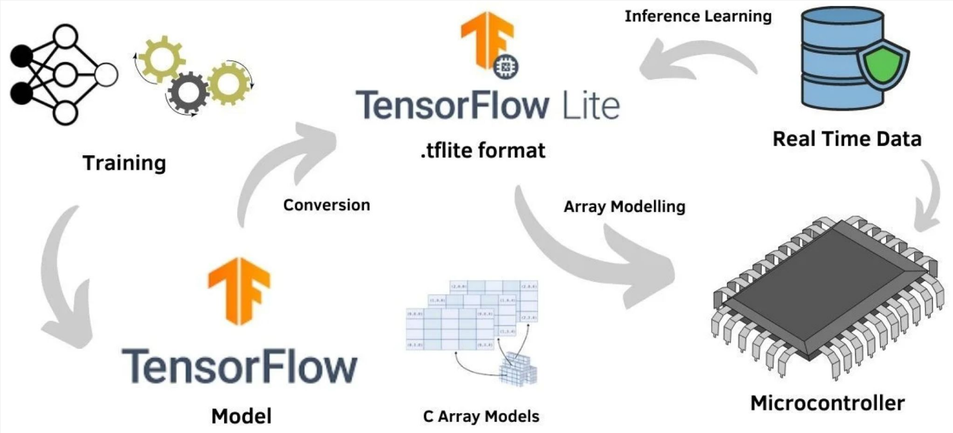
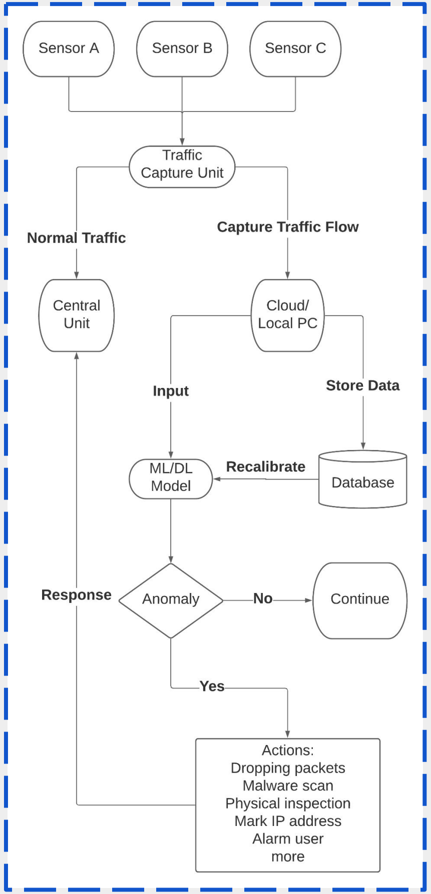


Figure 13: Illustration [18]

Flow of Network Traffic and Anomaly Detection



Flow Chart 1: **Flow of Traffic** [4]

Data-sets for IoT Anomaly based IDS

Sr. no.	Dataset	Botnets	ML techniques
1.	N-Baiot	Mirai, BashLite	Deep Autoencoders, Local Outlier Factor, One-Class Support Vector Machines and Isolation Forest algorithms
2.	Doshi et al. (2018)	DDoS attacks using Mirai-derived IoT botnets	k-Nearest Neighbors, Support Vector Machines, Decision Tree, Random Forest and Artificial Neural Networks algorithms
3	McDermott et al. (2018)	Mirai	text recognition deep learning algorithm
4	Shire et al. (2019)	IoT Malware Traffic	Convolutional Neural Networks

Business Prospects of IOT Security

Analyzed the target market to be:

- Health-Care facilities
- Smart cities
- Finance
- Manufacturing\Production facilities

Global Market Survey

According to a report by **MarketsandMarkets**, the global IoT security market size is expected to grow from **USD 12.5 billion in 2020 to USD 36.6 billion by 2025**, at a compound annual growth rate (CAGR) of 23.9% during the forecast period.

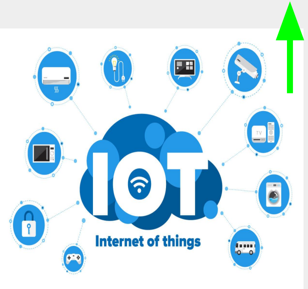
Product Definition: ML for “IDS in IIOT Nets”, using Stable - Classifiers such as Naive-Bayes / Decision-Trees and a dataset (IOT 23) considering multiple cyber attack profiles.

Development: Implementation of Software and validation for detection of Anomalies.

Pricing: Strategy of Pricing will be based on the cost utilized for SW development + Time consumed(days per resource) + considerable profit margin for further development.

Sales: Strategy for sales will be classified regionally considering regulations.

Support: Further customer support



GANTT Chart

NUMBER	TASK TITLE	START DATE	DUE DATE	May				June				July			
				1	2	3	4	1	2	3	4	1	2	3	4
1	Survey of existing dataset	05/01/23	5/16/23	🟩	🟩										
2	Examine existing methologies	05/01/23	5/16/23	🟦	🟦										
3	Approach Selection	5/16/23	5/23/23			🟪									
4	Implementation	5/23/23	6/13/23				🟨	🟨	🟨	🟨					
5	COSIMA submission	5/23/23	5/31/23				🟥								
6	Testing	06/06/23	07/04/23						▨	▨	▨				
7	Documentation	6/13/23	7/12/23							🟦	🟦	🟦			
8	Final Presentation	7/12/23	7/17/23										🟥	🟥	

Workflow

- Survey of existing datasets available for IoT networks
- Examine existing methodologies or concepts for IoT security.
- Approach selection for IoT security
- Implementation
- Testing
- Documentation

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Questions

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