Cyber security automation for an industrial 4.0 garment manufacturing system

2021-11

Our Team

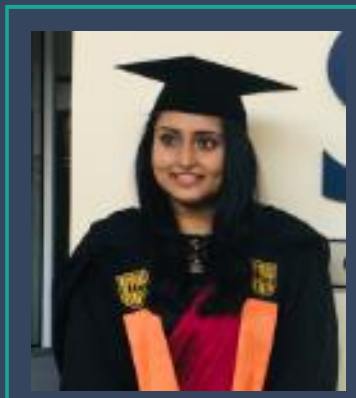
Dasunpriya Kalhara
IT18139440
Cyber Security

Anuka Jinadasa
IT18132410
Cyber Security

Udara De Alwis
IT18136098
Cyber Security

Dinuwan Randunu
IT18133578
Cyber Security

Supervisor
Prof. Pradeep Abeygunawardhana
Professor / Head | Department of Computer Systems Engineering



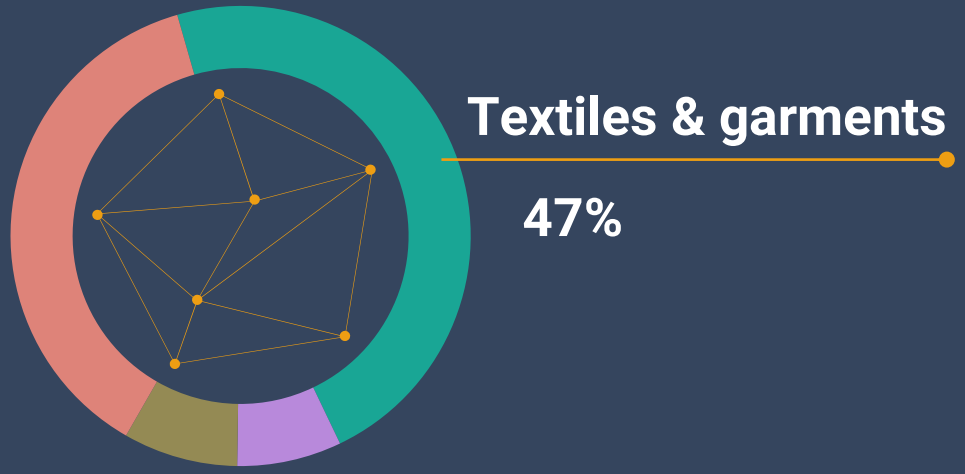
Co - Supervisor
Ms. Wellalage Sasini Nuwanthika

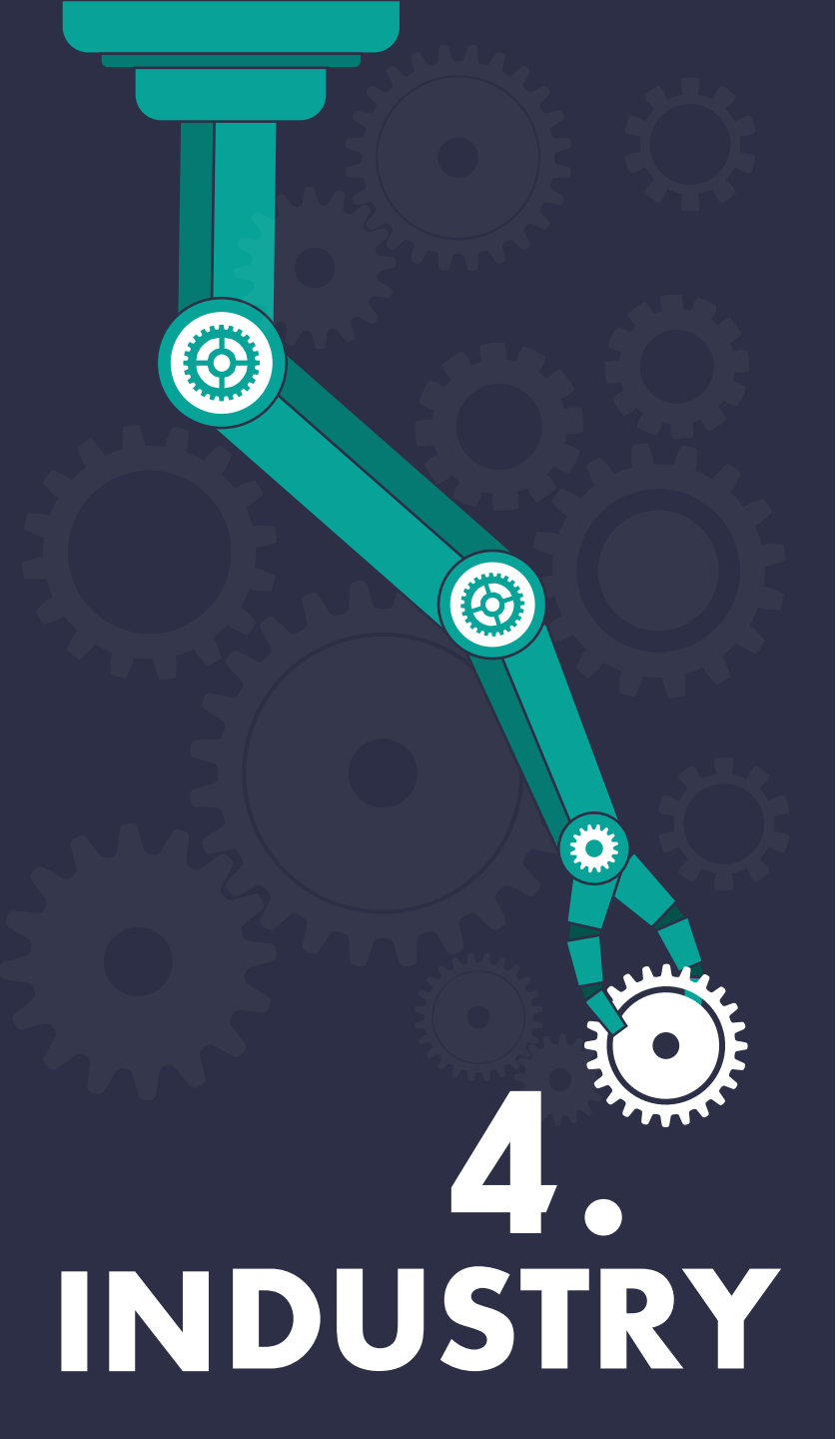
External – Supervisor
Mr. Gamini De Alwis

Introduction

Security is neglected when migrating into Industry 4.0 by most companies.

- **Why Garment Industry ?**





Research Question

How can we secure industrial 4.0 garment manufacturing system ?

Challenges:

- The development of the secure network environment.
- Collaboration between different systems.
- Centralized security management.
- Secure communication.
- Insecure data.
- Initial cost.
- Lack of strategy to industry 4.0.

Main and Sub Objectives

Security implementation for the potential challenges of the smart manufacturing system

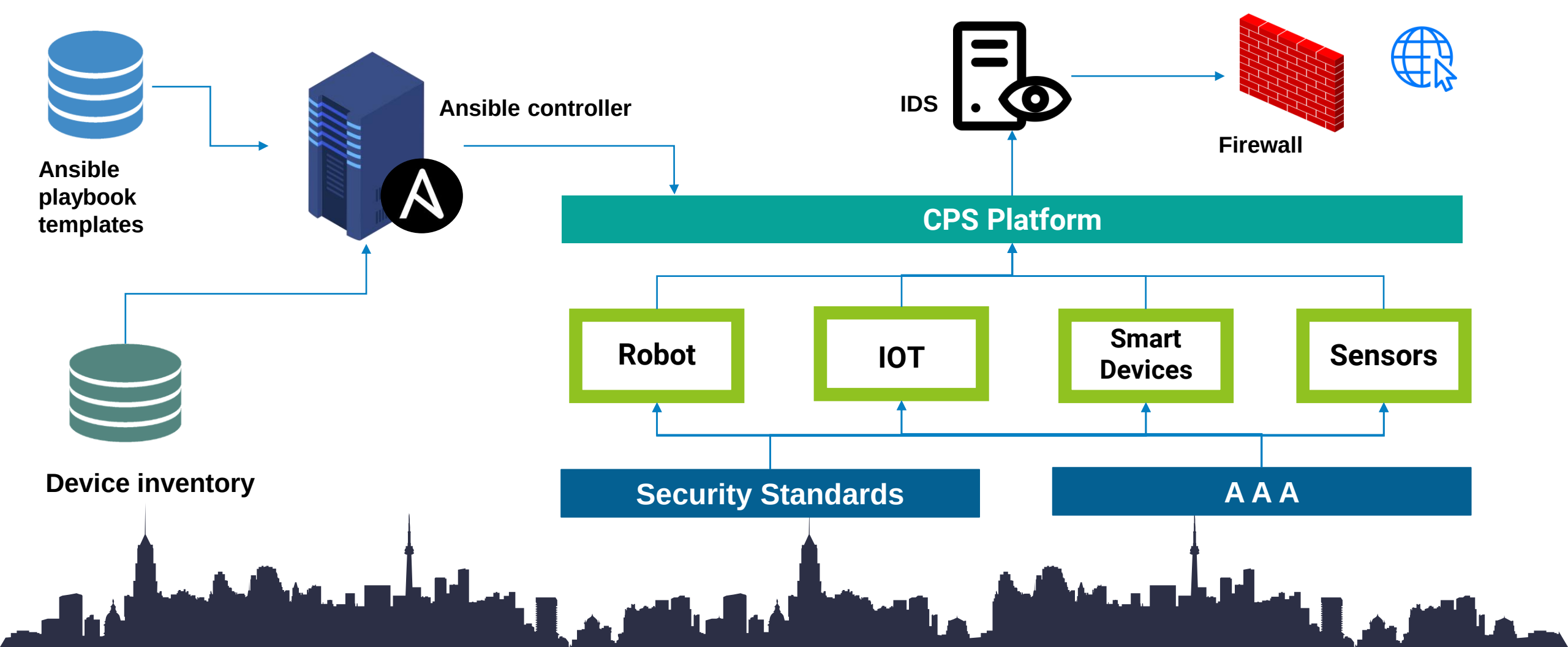
Authentication & access monitoring

Security updates

Security configurations

Intrusion Detection

Overall System Diagram



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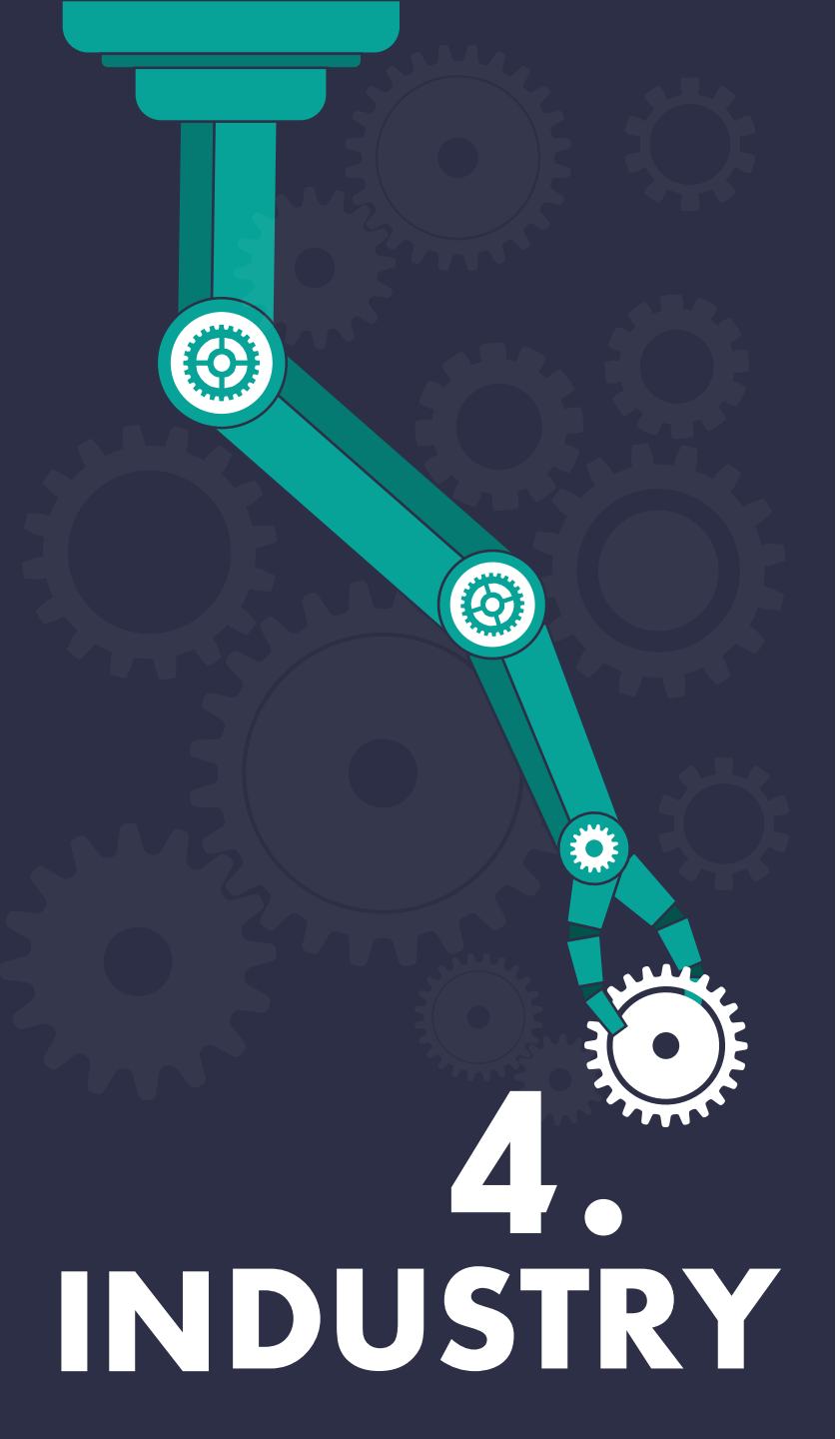
Introduction



Background

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Insecure Default Settings

Devices or systems shipped with insecure default settings or lack the ability to make the system more secure by restricting operators from modifying configurations [1].

Research Gap

	SCAP Workbench [2]	CIS-CAT Pro [3]	Proposed Tool
Ubuntu Linux	✗	✓	✓
Robot OS	✗	✗	✓
Raspberry OS	✗	✗	✓

Research Question

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How can we Automate Security configuration for CPS devices?

Specific & Sub Objectives

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Specific Objective :

A tool for Automating security configurations

Sub Objectives :

- Audit security configurations
- Centralized device configuration management
- Generate Audit reports

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IT18139440

RESEARCH METHODOLOGY

System Diagram

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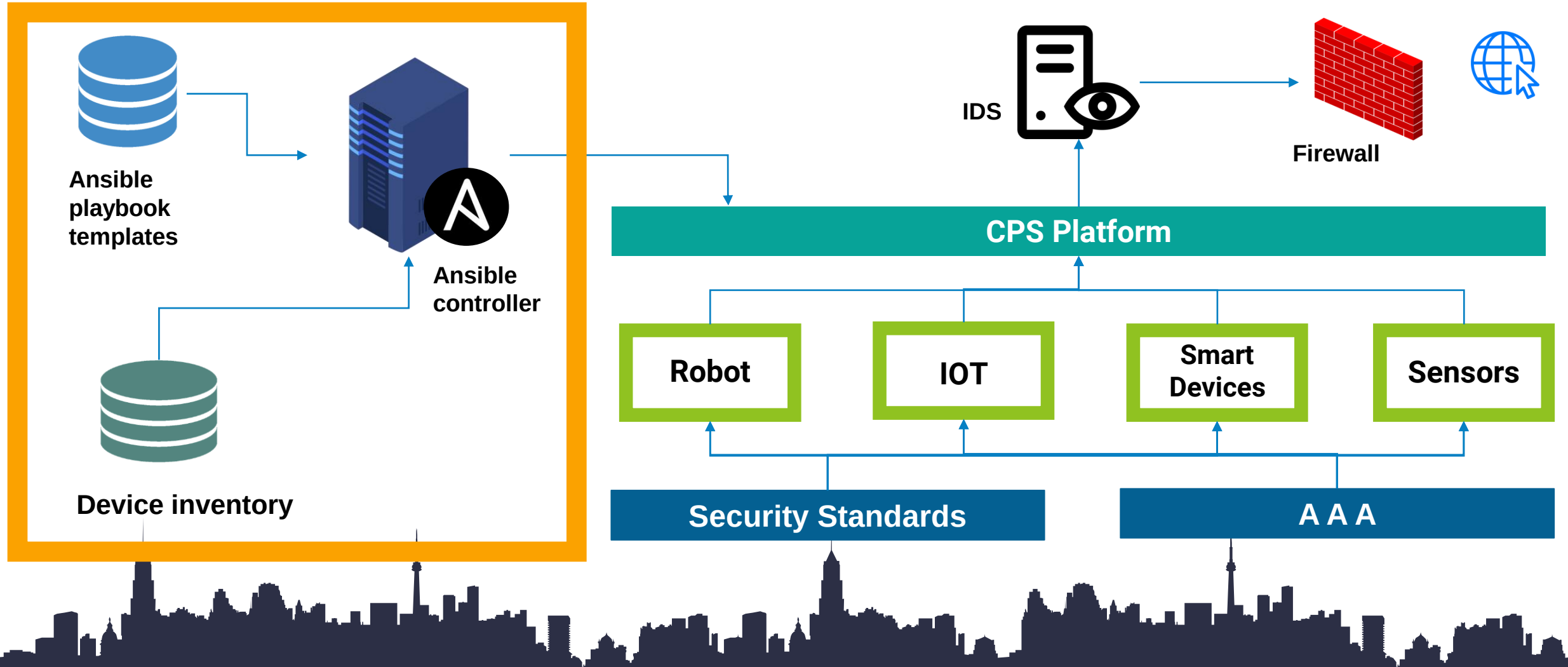

Technologies, techniques & algorithms

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Software specification

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Requirements

- A Python tool to automate security configurations.
- Add new audit and remediations to the python tool.
- Select and deselect remediations to create optimize compliance profile based on resource usage of the devices.
- A report generating function to generate audit reports.

Work Breakdown Structure

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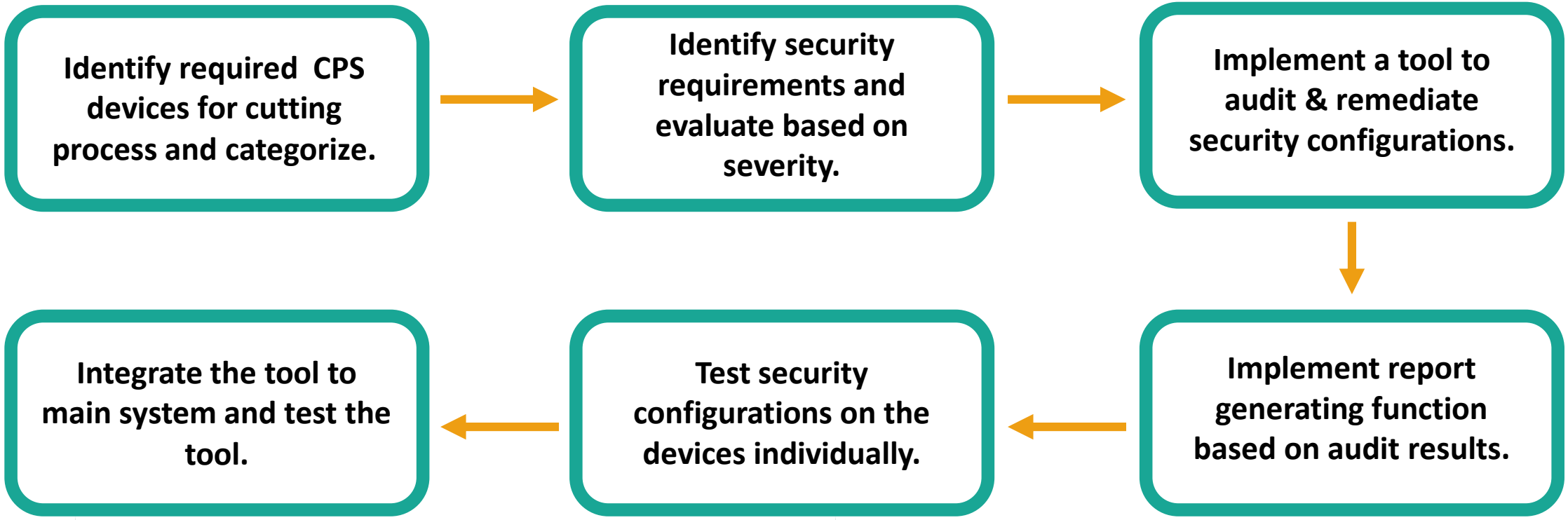

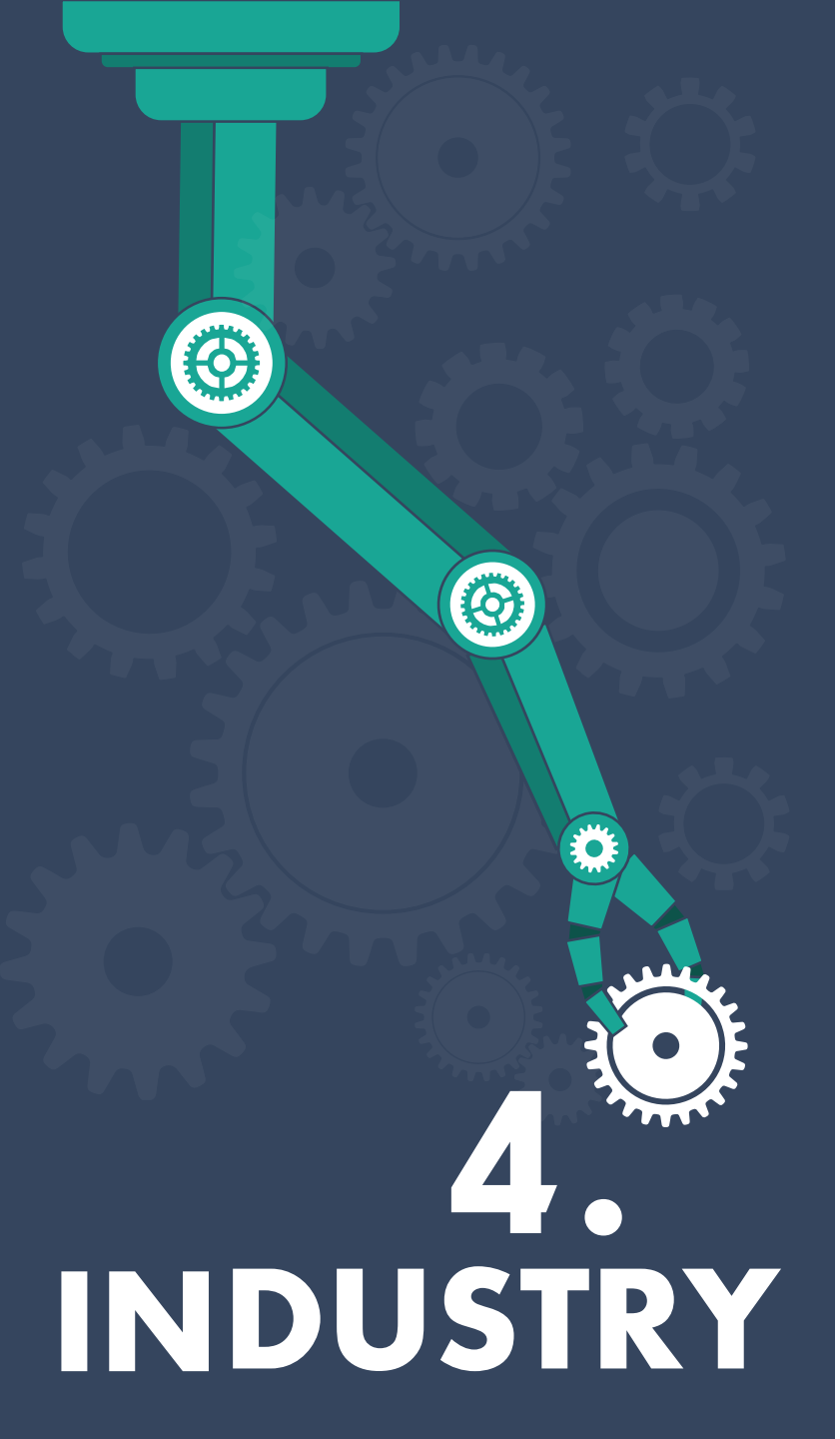

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SUPPORTIVE INFORMATION

Commercialization

Targeted Audience: Small and medium 4.0 industries or industries that migrating into industry 4.0

Social Media - We will gauge our target audience through Facebook, Twitter, and Instagram campaigns.

REFERENCES

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•[2] “SCAP Workbench | OpenSCAP portal.” https://www.open-scap.org/tools/scap-workbench/ (accessed Mar. 06, 2021).

•[3] “CIS Benchmarks™,” CIS. https://www.cisecurity.org/cis-benchmarks/ (accessed Mar. 06, 2021).

Udara De Alwis

IT18136098

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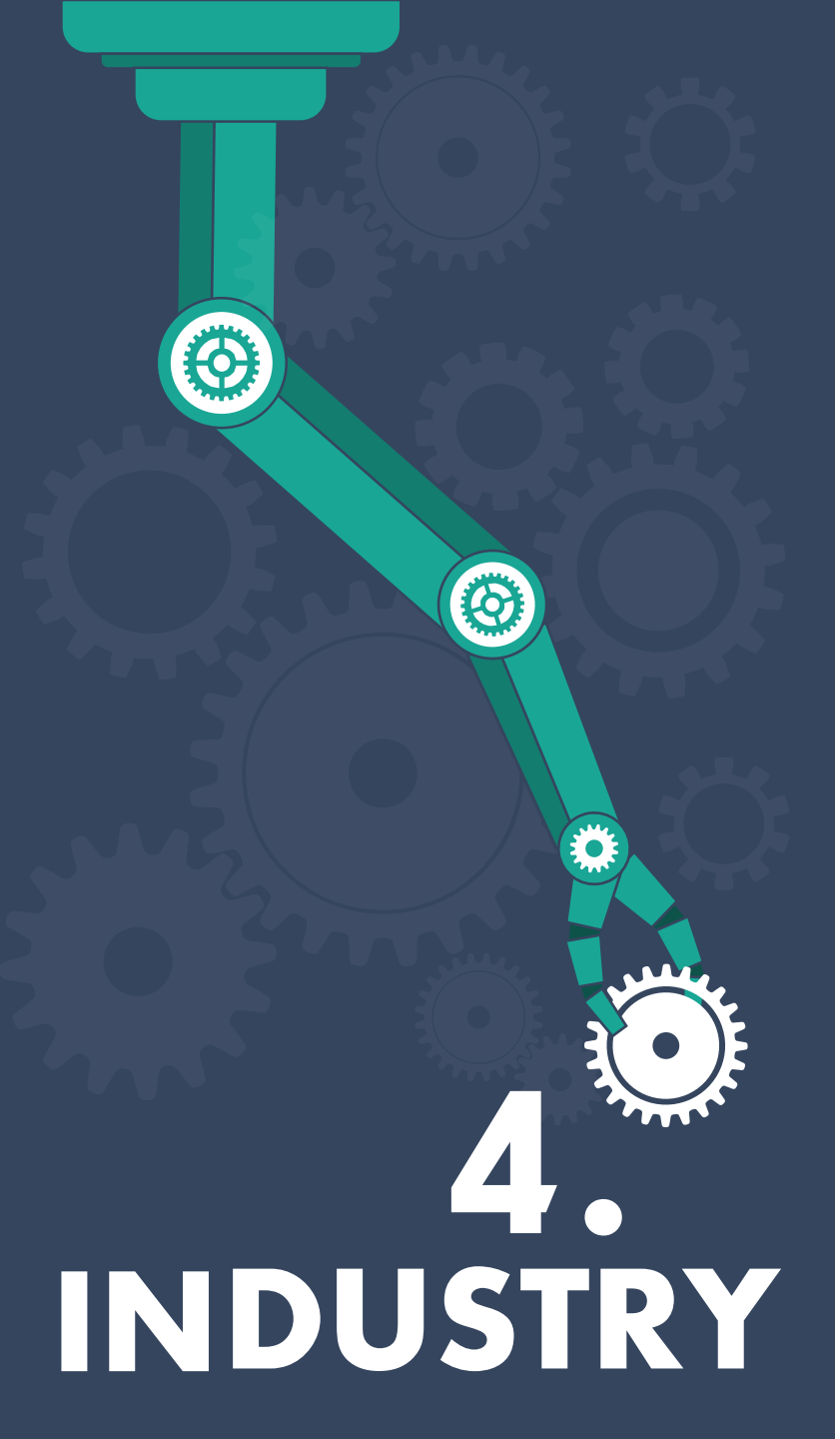
Introduction



Background

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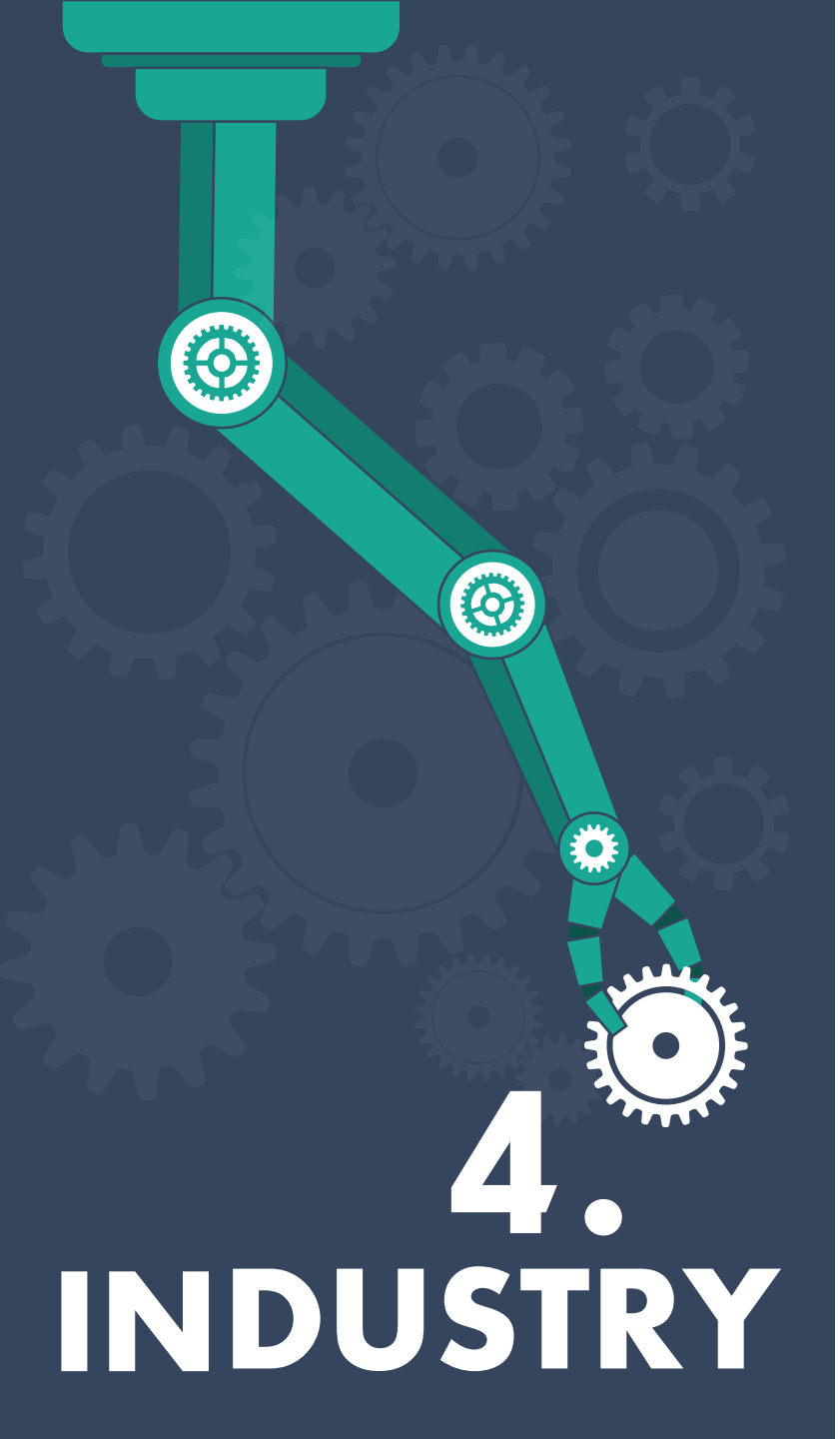
- Manufacturing standards, are a challenge that IoT has to overcome. Manufacturers do not spend enough effort and resources on security[1].
- They are very industry specific and mostly just suggested best practices.
- IoT Devices lack having guidance for security policy enforcement.
- Policies are not been focused to enforce in the design stage.
- Lack of compliance.[1]
- Lack of secure update mechanism.[1]



Background cont'd

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Research Gap

- Industrial 4.0 automation is driven by focusing on the functionality and SAM/SMV(Standard Allowed Minute/ Standard Minute Value) rather than security.
- There are few IoT security frameworks in various stages of development. (ETSI(European Telecommunications Standards Institue)EN 303 645, IoT Security Compliance Framework, OWASP ISVS, ENISA, NIST)[2][3].

- Comparison of the security standards and best practices for the different industrial automation domains are available.[4]
- There hasn't been a powerful enough push to make universal IoT security standards.

Research Question

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How to identify and create security policies suitable for IoT and CPS devices.

How to Integrate security strategies and policies suitable for IoT and CPS devices.[5]

How to implement proper security update mechanism.

Specific & Sub Objectives

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Specific Objective :

- Create security policies for IoT and CPS
- Update management

Sub Objectives :

- Password policy creation
- Access policy creation
- Firewall policy creation
- Acceptable use policy creation
- Update policy implementation

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RESEARCH METHODOLOGY

System Diagram

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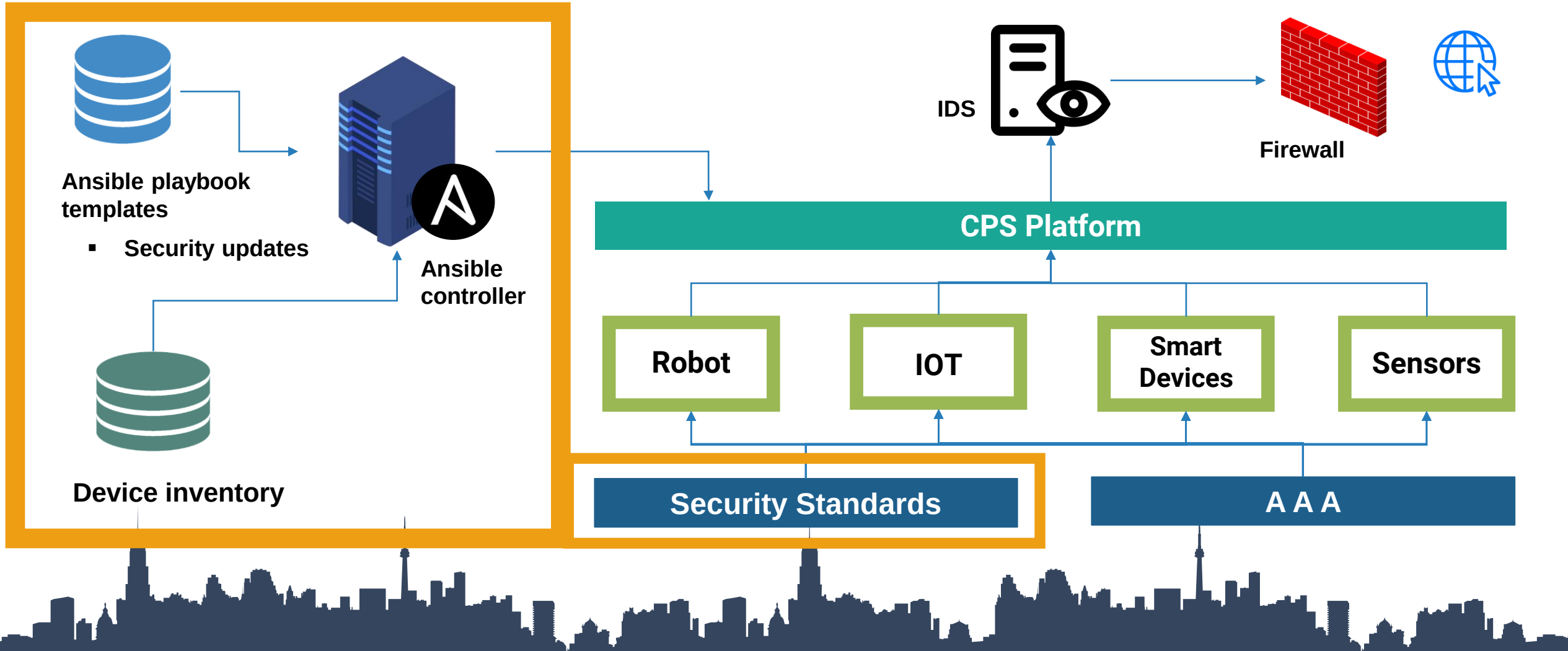

Technologies, techniques & algorithms

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Techniques

- NIST
- ENISMA

Requirements

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- Meeting Stakeholder requirements.
- Risk identification and assessment.
- Security policy development and privacy by design.
- Hardware root of trust.

Work Breakdown Structure

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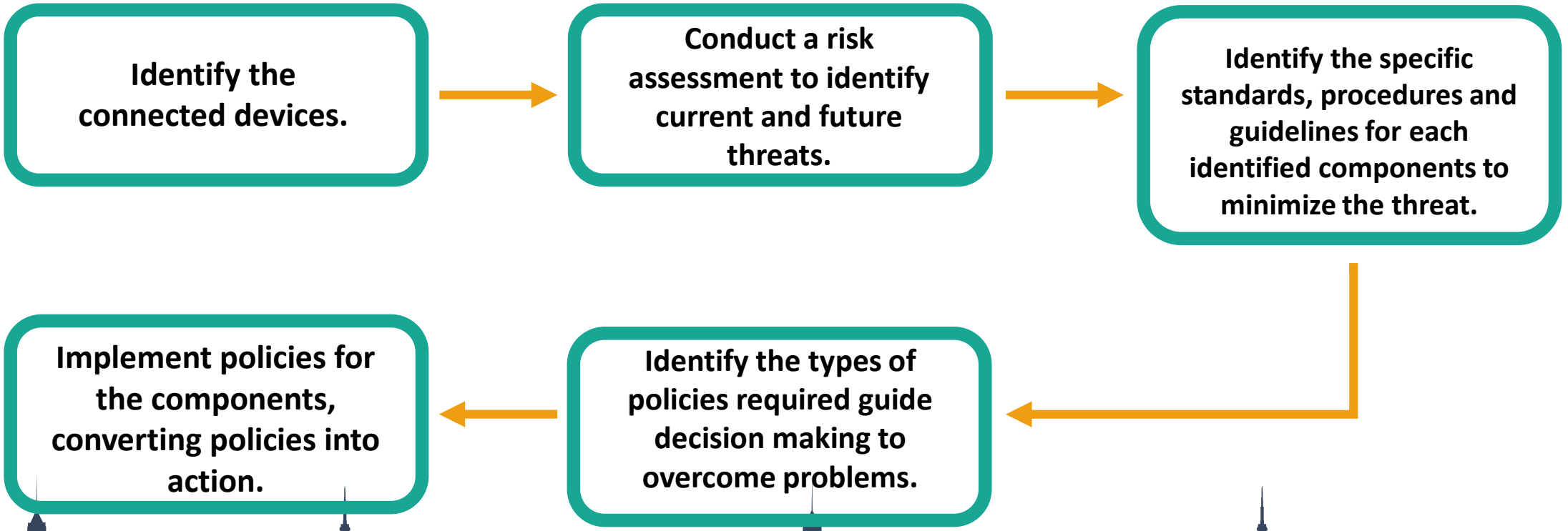
❖ **Security standards and policy development**



Work Breakdown Structure

cont'd

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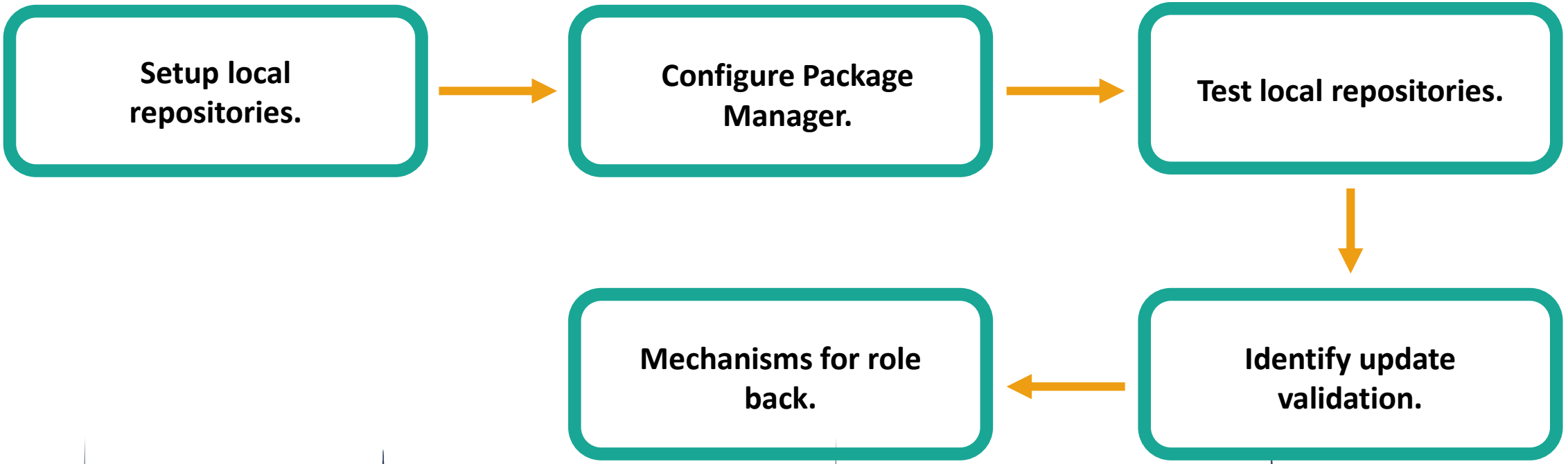
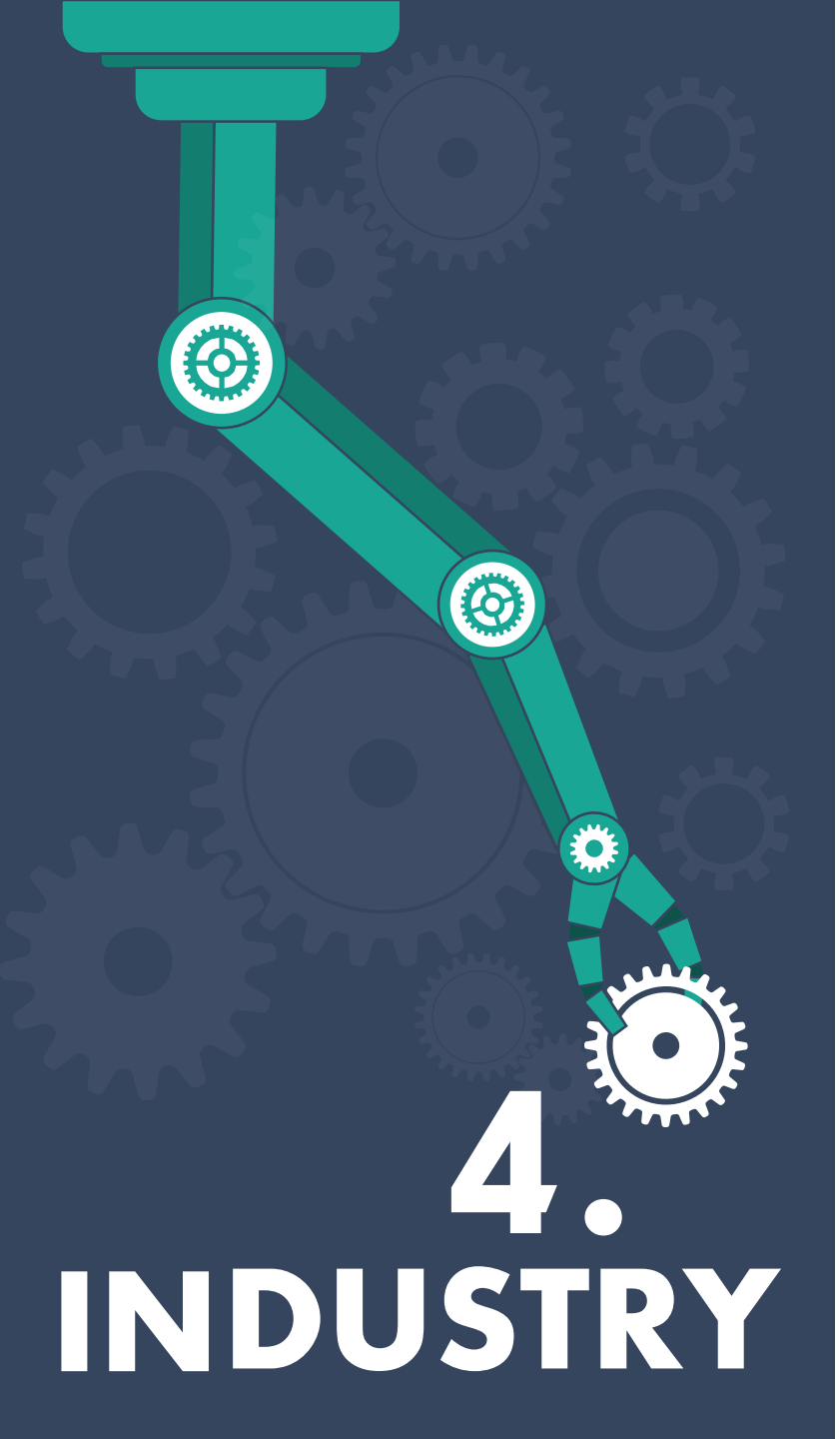
- **Update management**





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SUPPORTIVE INFORMATION

Commercialization

Targeted Audience: Small and medium 4.0 industries or industries that migrating into industry 4.0

Social Media - We will gauge our target audience through Facebook, Twitter, and Instagram campaigns.

REFERENCES

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IT18136098

[1]“Top 10 IoT Security Issues: Ransom, Botnet Attacks, Spying,” *Intellectsoft Blog*, Jul. 30, 2020. https://www.intellectsoft.net/blog/biggest-iot-security-issues/ (accessed Mar. 07, 2021).

[2]“What Are the IoT Security Standards?,” *SDxCentral*. https://www.sdxcentral.com/5g/iot/definitions/what-are-iot-security-standards/ (accessed Mar. 07, 2021).“Comparison of IoT Security Frameworks,” *Comparison of IoT Security Frameworks*. https://www.eurofins-cybersecurity.com/news/comparison-iot-security-frameworks/ (accessed Mar. 07, 2021).

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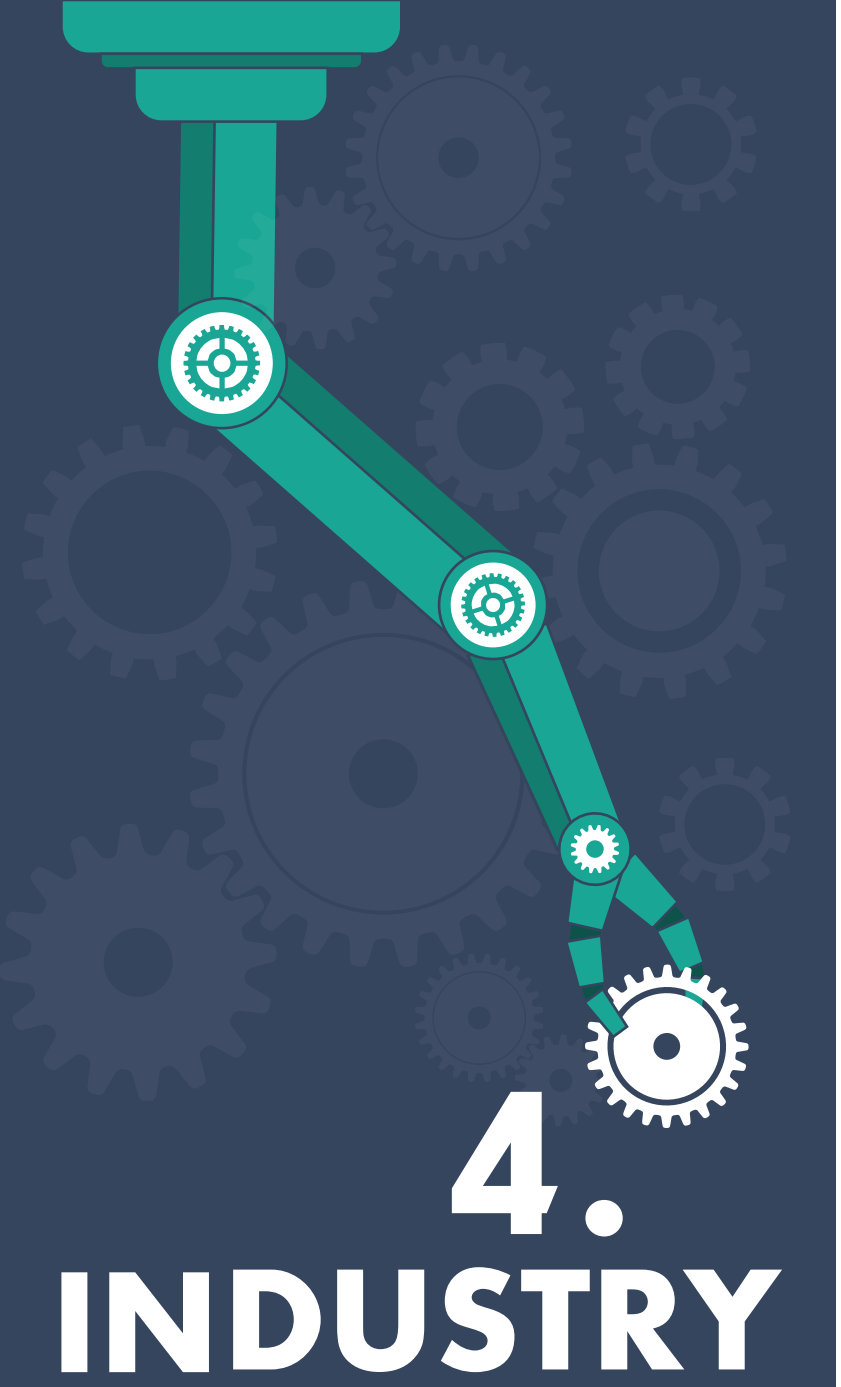
Anuka Jinadasa

IT18132410

Cyber Security

Anuka Jinadasa
IT18132410

Introduction



Background

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- securing smart devices is not a priority for vendors.
- Commercial security solutions are expensive to establish and maintain. [1] [2]

Research Gap

	McAfee NSP [3]	Cisco Firepower	Trend Micro TippingPoint	Proposed Solution
Signature based	✓	✓	✗	✓
Anomaly based	✓	✓	✓	✓
Base Price	$10,995	$100,000	$6,000	$500

Research Question

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IT18132410

How can we implement cost effective, lightweight yet fully capable firewall & IDS/IPS ?

Specific & Sub Objectives

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Specific Objective :

implement a firewall and IDS/IPS system

Sub Objectives :

- Provide easy access dashboard to the user.
- Visualize network behavior to user.
- Enable add/ remove firewall rules through the dashboard.
- Alert user when an anomaly occurs. [1]

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RESEARCH METHODOLOGY

System Diagram

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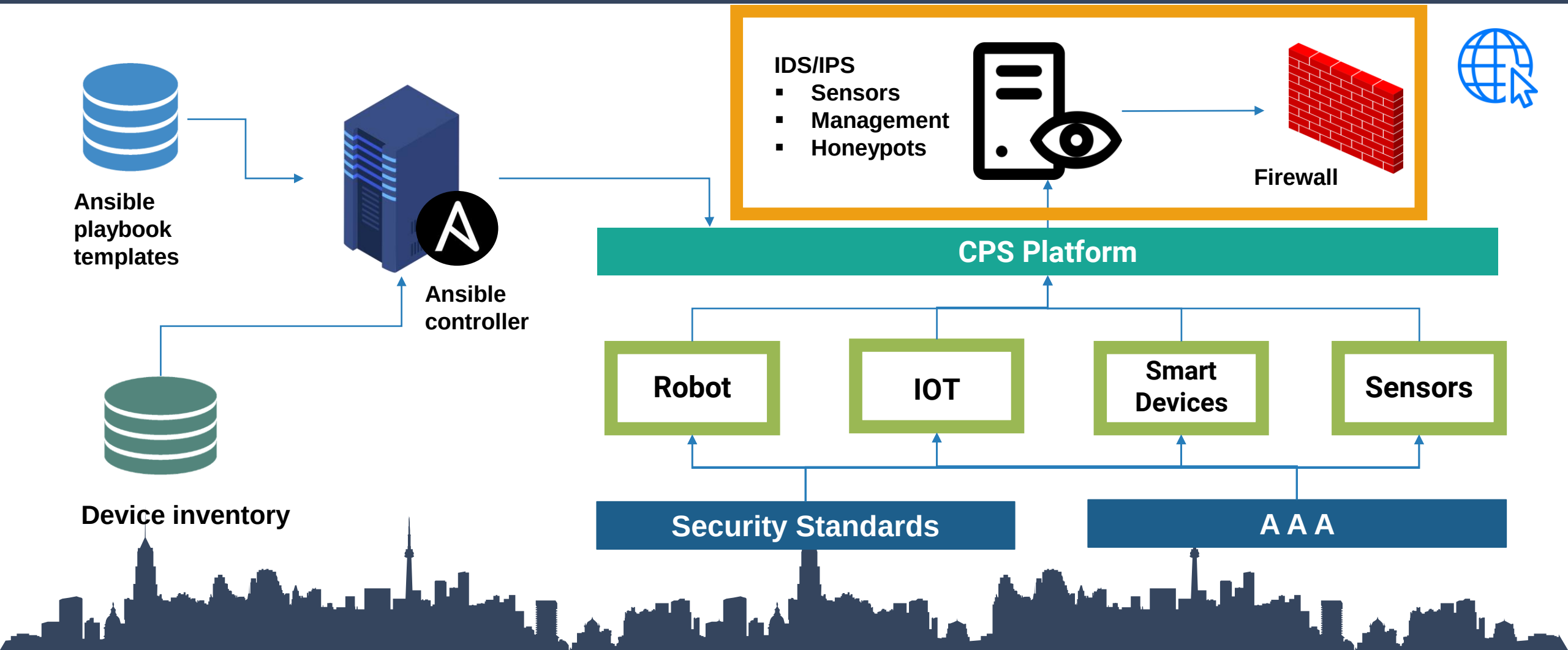

Technologies, techniques & algorithms

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Algorithms

- Signature based detection
- Pattern based detection [4]

Software specification

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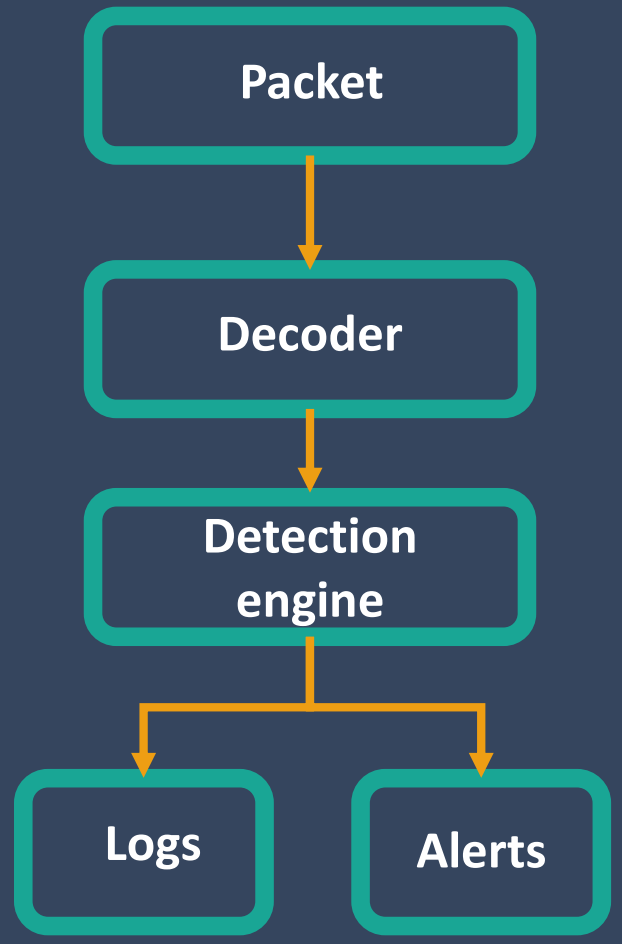
Requirements

- Logging & alerting network behavior
- Packet decoder & Detection engine
- Visualize network behavior via dashboard.
- Add/ remove firewall rules via dashboard.
- Minimize false positive & false negative.
- Configure according to the security policies



Work Breakdown Structure

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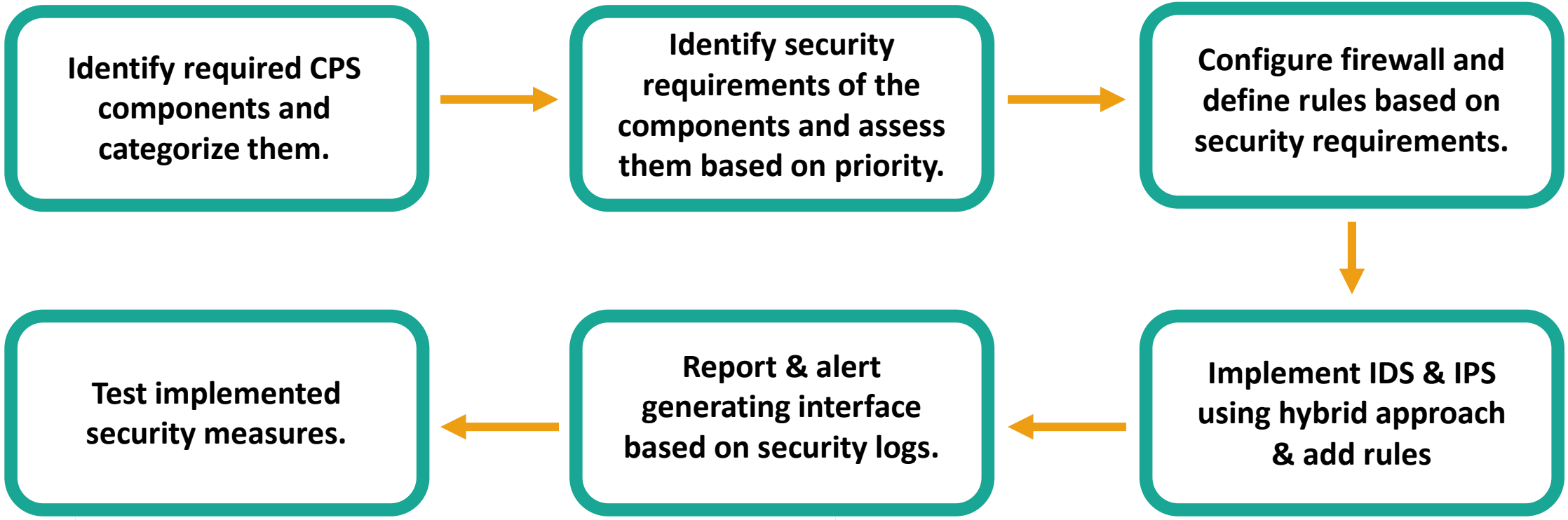

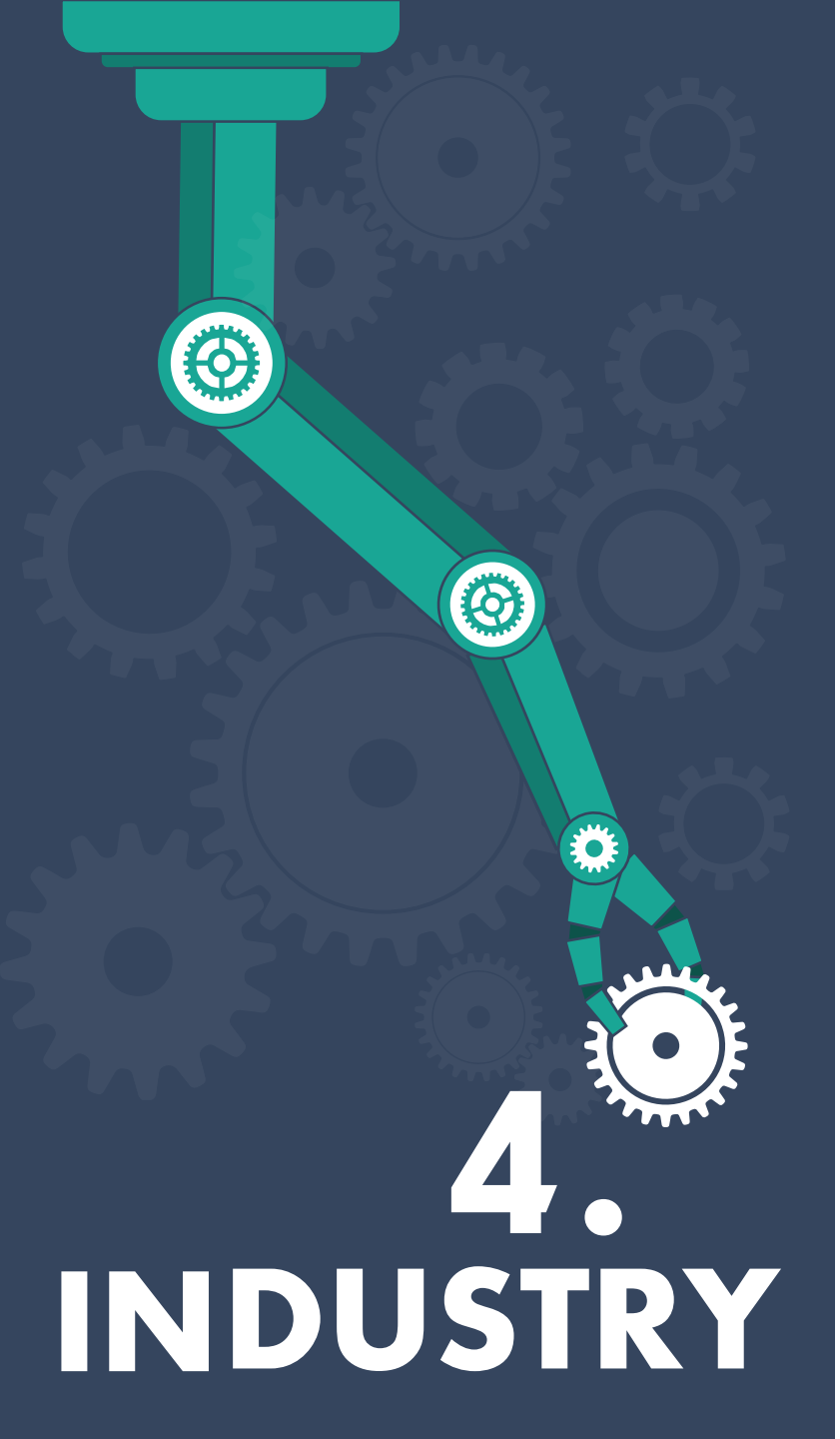

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SUPPORTIVE INFORMATION

Commercialization

Targeted Audience: Small and medium 4.0 industries or industries that migrating into industry 4.0

Social Media - We will gauge our target audience through Facebook, Twitter, and Instagram campaigns.

REFERENCES

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IT18132410

[1] N. Gupta, V. Naik and S. Sengupta, "A firewall for Internet of Things," 2017 9th International Conference on Communication Systems and Networks (COMSNETS), Bangalore, 2017, pp. 411-412, doi: 10.1109/COMSNETS.2017.7945418.

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Dinuwan Randunu

IT18133578

Cyber Security

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IT18133578

Introduction

Background

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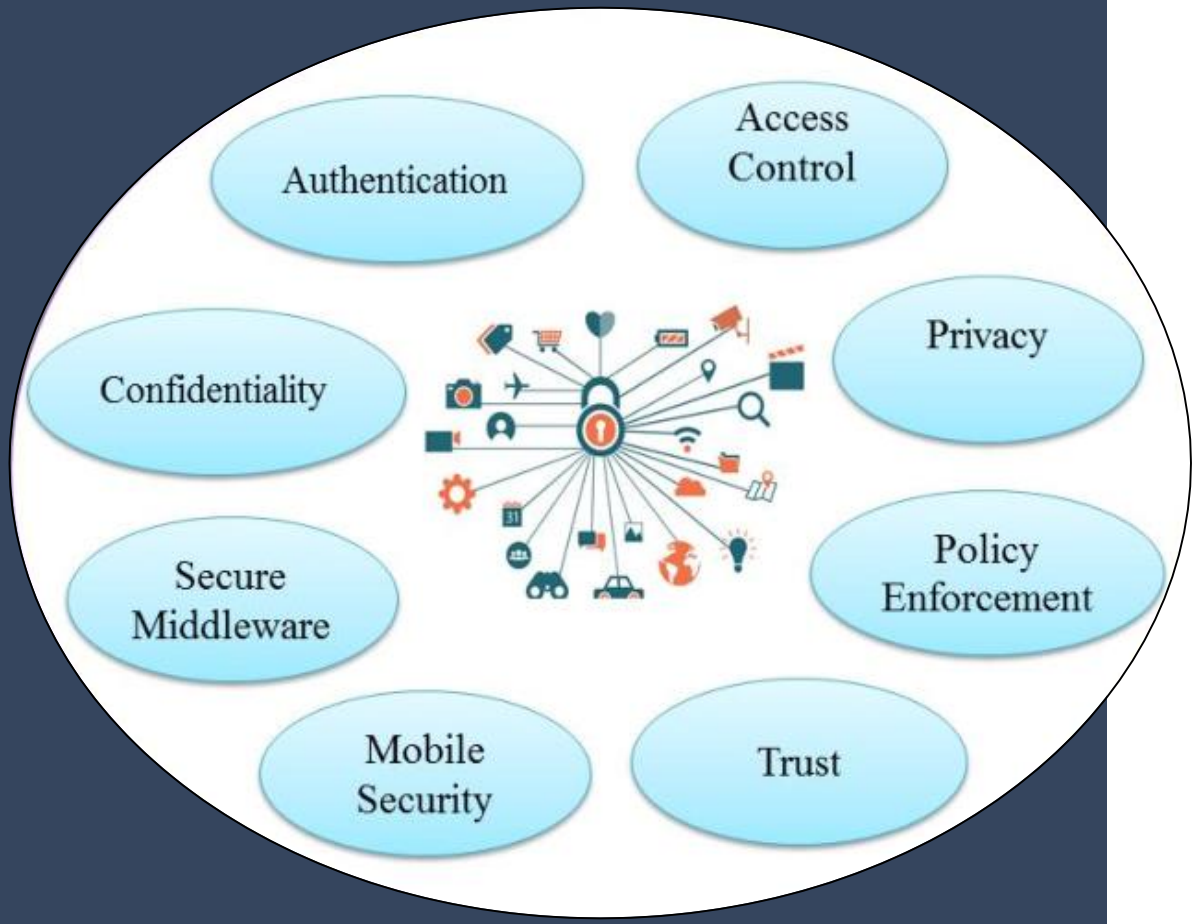
- Primarily focus only on functionality of industrial 4.0 automated systems.
- Security has been shared with a third party.
- Insecure Data
- Ethernet and the IP protocol stack are becoming a core part of plant and factory networks. [1]
- Connected to the internet over TCP/IP protocols without additional protection. [2]



Research Gap

Industrial 4.0 automation is driven by focusing on the functionality rather than security.

Research Question

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How can we achieve

- Authentication
- Authorization
- Accounting

in cps devices ?

Specific & Sub Objectives

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IT18133578

Specific Objective :

Establish Authentication, authorization and accounting (AAA) and ensure security.

Sub Objectives :

- Access log visualization.
- Report generation.
- Alert user when an anomaly occurs.

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RESEARCH METHODOLOGY

System Diagram

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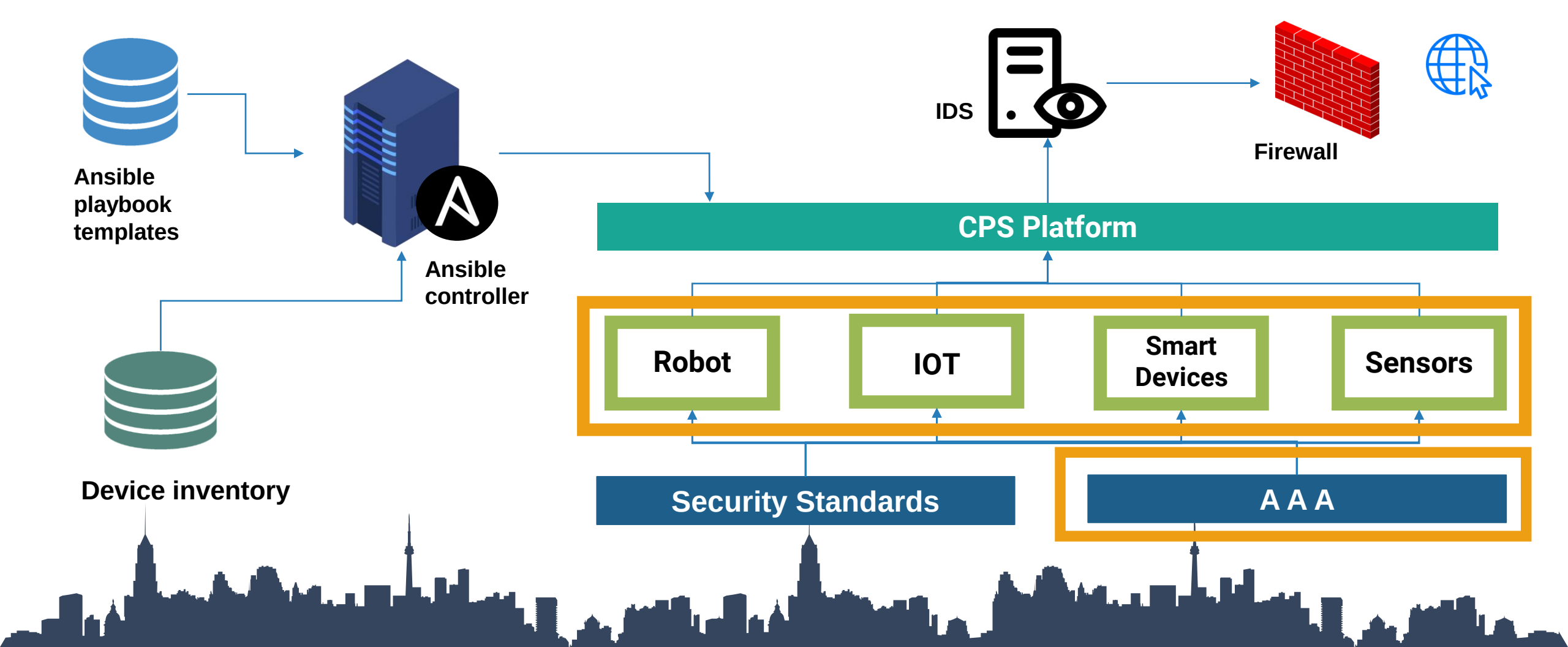

Technologies, techniques & algorithms

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IT18133578

python™

django

elastic + logstash + kibana

BASH
THE BOURNE-AGAIN SHELL

octave®

NIST

Software specification

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IT18133578

Requirements

- Database to store access logs and error logs.
- Implement a Physical Security System
- Data visualization from access logs.
- Report generation from access logs.

Work Breakdown Structure

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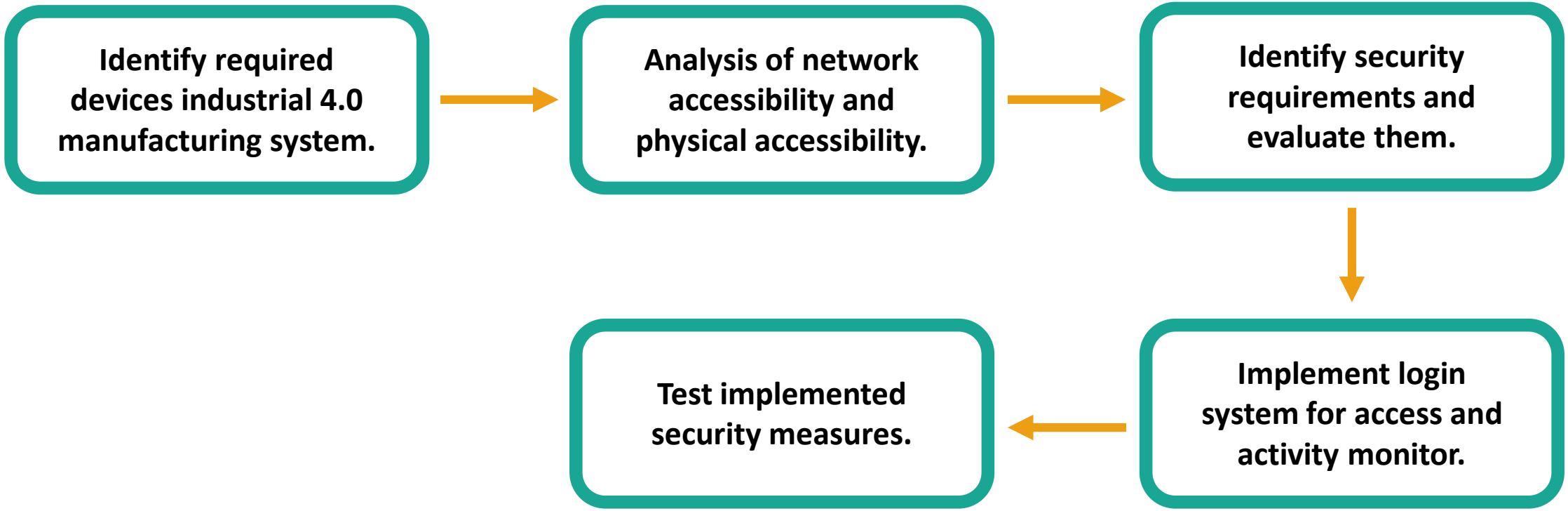
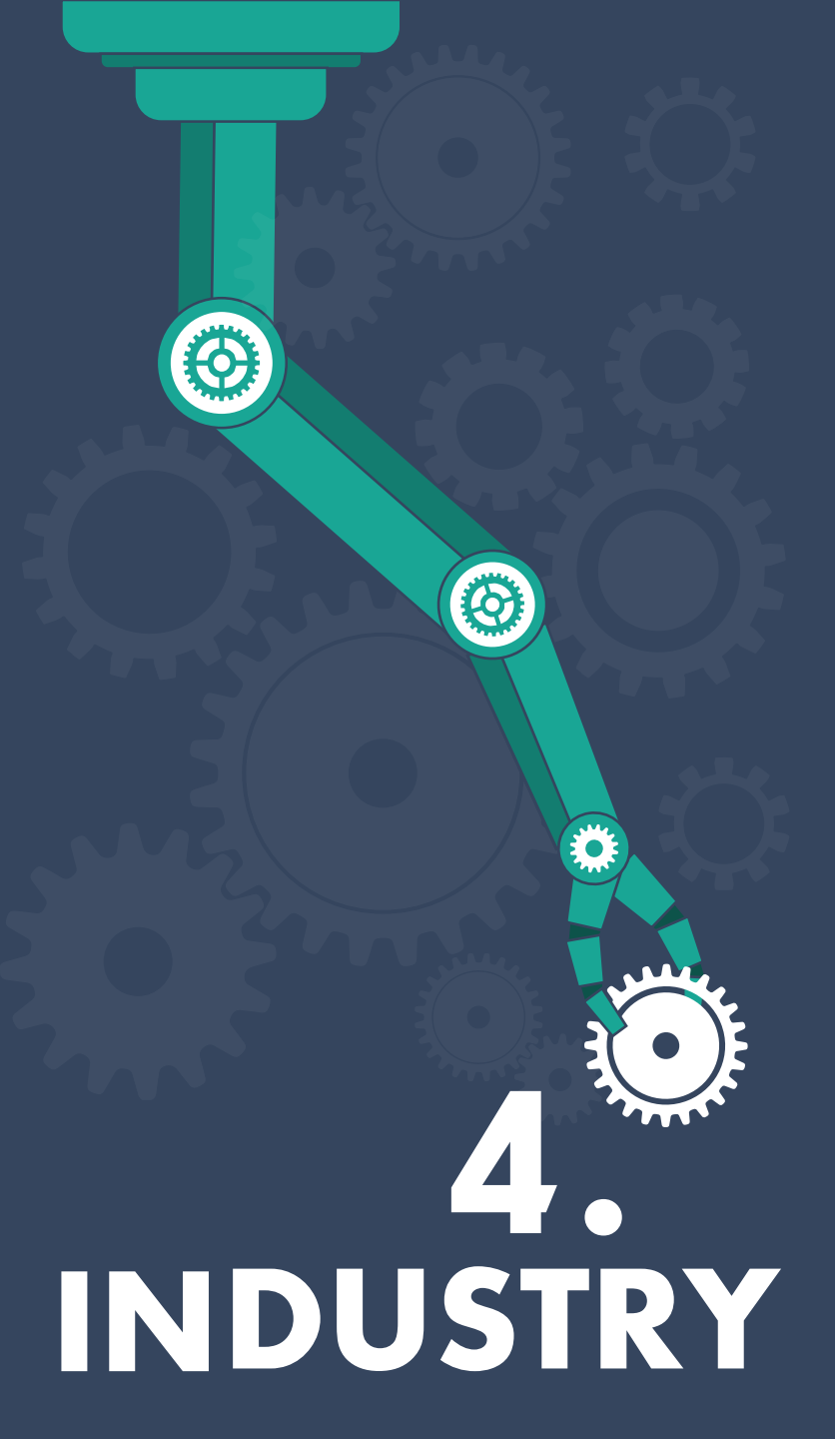
IT18133578





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SUPPORTIVE INFORMATION

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Social Media - We will gauge our target audience through Facebook, Twitter, and Instagram campaigns.

REFERENCES

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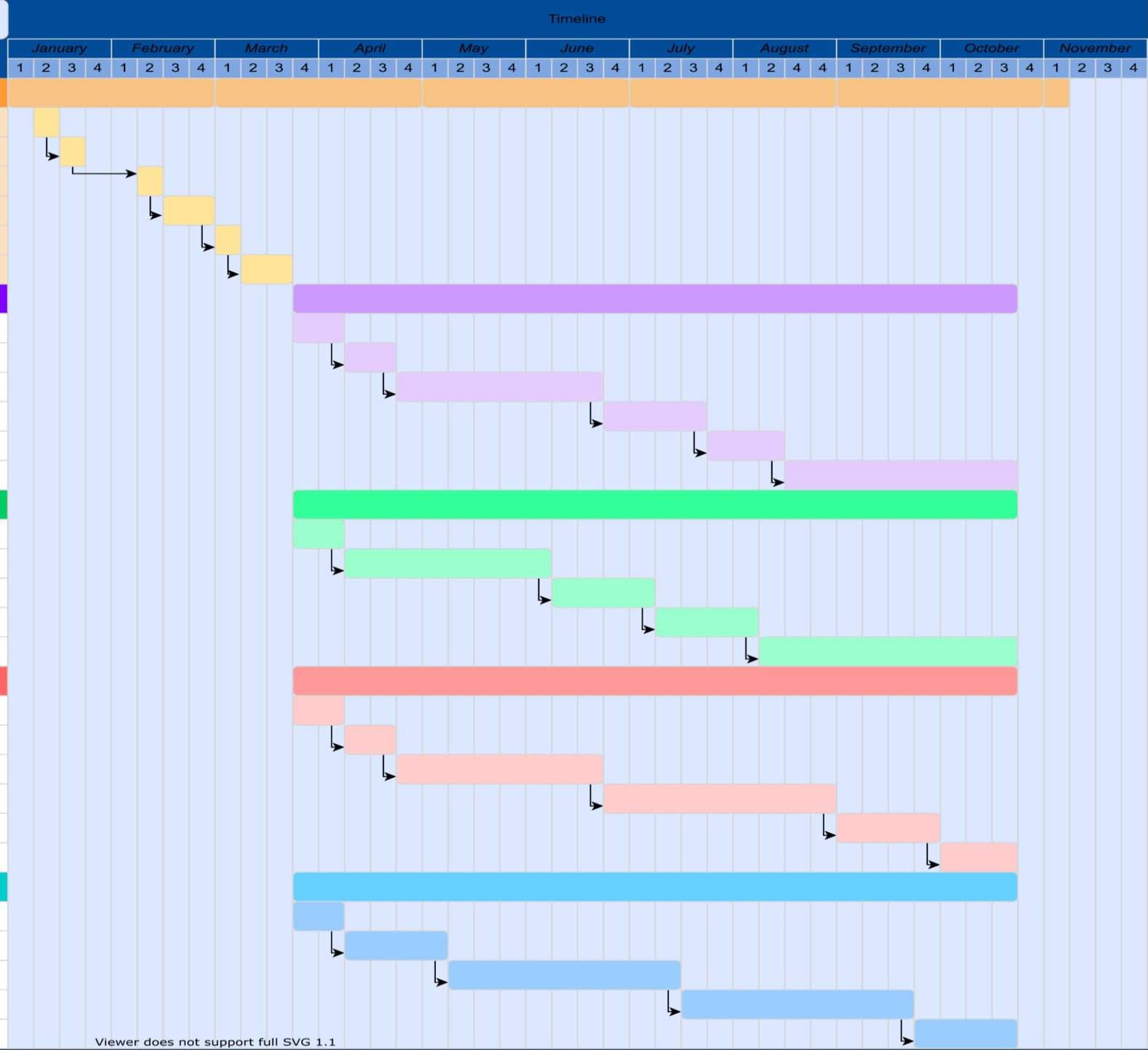
Gantt chart & Tentative budget allocation

#	Task Name	Duration	Start	ETA
Complete project execution		40 weeks	10-01-21	01-11-21
1	Online project Registration	1 week	10-01-21	17-01-21
2	Topic Assessment Form submission	1 week	18-01-21	22-01-21
3	Project Charter submission	1 week	08-02-21	12-02-21
4	Proposal report draft submission	2 weeks	15-02-21	26-02-21
5	Proposal presentation	1 weeks	28-02-21	08-03-21
6	Proposal report	2 weeks	08-03-21	21-03-21
7	Security Configuration	28 weeks	22-03-21	18-10-21
7.1	Identify required CPS devices	2 weeks	22-03-21	05-04-21
7.2	Identify and evaluate security requirements o...	2 weeks	06-04-21	20-04-21
7.3	Implement a tool for security hardening	8 weeks	20-04-21	15-06-21
7.4	Implement report generating tool	4 weeks	15-06-21	12-07-21
7.5	Test Security Configuration	3 weeks	13-07-21	02-08-21
7.6	Integrate hardening tool to the entire soluti...	9 weeks	03-08-21	18-10-21
8	Security standards and policy development	28 weeks	22-03-21	18-10-21
8.1	Identify the connected devices	2 weeks	22-03-21	05-04-21
8.2	Conduct a risk assessment	8 weeks	05-04-21	01-06-21
8.3	Identify the specific standards, procedures a...	4 weeks	01-06-21	28-06-21
8.4	Identify the types of policies required	4 weeks	28-06-21	26-07-21
8.5	Implement policies for the components	10 weeks	26-07-21	18-10-21
9	Implementations of Firewall & IDS	28 weeks	22-03-21	18-10-21
9.1	Identify required CPS components and categori...	2 weeks	22-03-21	05-04-21
9.2	Identify security requirements of the compone...	2 weeks	05-04-21	20-04-21
9.3	Configure firewall and define rules based on...	8 weeks	20-04-21	15-06-21
9.4	Implement IDS & IPS using a hybrid approach	9 weeks	15-06-21	09-08-21
9.5	Report generating tool based on audits and se...	4 weeks	09-08-21	06-09-21
9.6	Test implemented security measures	3 weeks	06-09-21	18-10-21
10	Authentication and access monitoring	28 weeks	22-03-21	18-10-21
10.1	Identify required devices	2 weeks	22-03-21	05-04-21
10.2	Identify security requirements	4 weeks	05-04-21	03-05-21
10.3	Analysis of network accessibility and physica...	9 weeks	03-05-21	05-07-21
10.4	Implement login system for access and activit...	9 weeks	05-07-21	06-09-21
10.5	Test implemented security measures	4 weeks	06-09-21	18-10-21



Item(s)	Cost(LKR)
Web server hosting	5000.00
Firewall + IDS/IPS hardware	1 8000.00
Physical security system hardware	5000.00
Raspberry Pi 3	1 2000.00
Total	**4 0000.00**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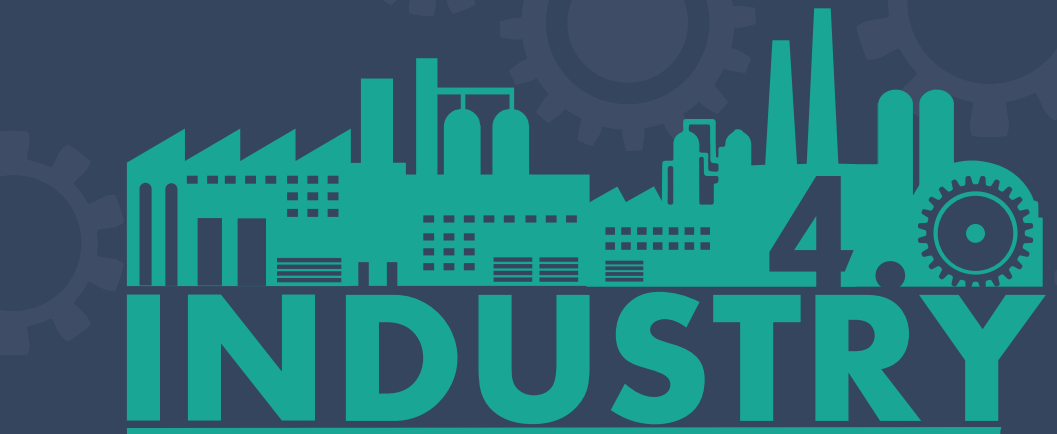

Thank You