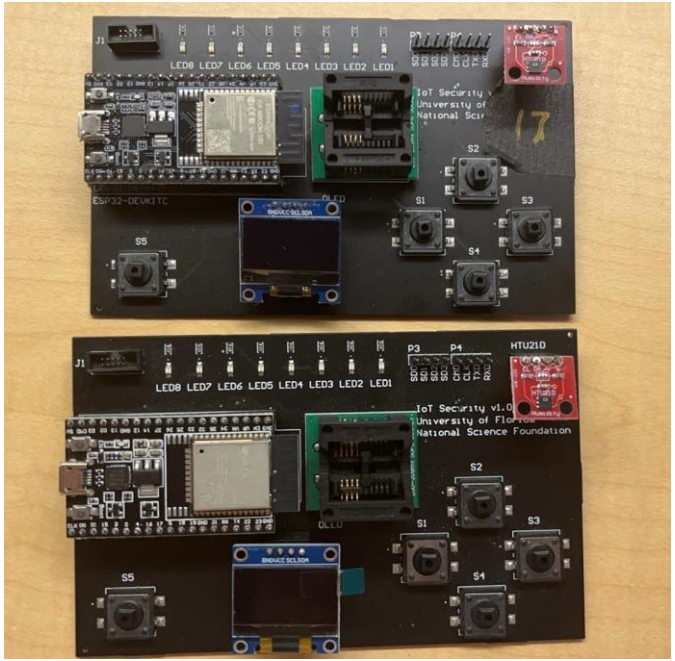
UF Herbert Wertheim College of Engineering
UNIVERSITY of FLORIDA

Cloud-based dual inspection system for factory environment

POWERING THE NEW ENGINEER TO TRANSFORM THE FUTURE

1 Description

System Overview

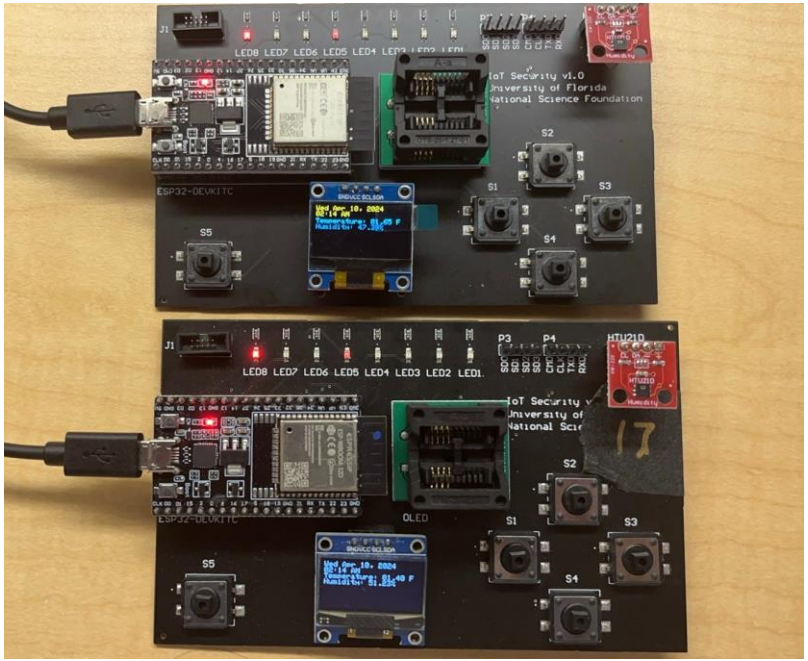


- Our project is a temperature and humidity alarm system designed for sensitive environments, especially factories where production is critical. Two ESPs act as temperature and humidity detectors, connected to a WIFI connection that sends a constant stream of temperature and humidity data to the AWS.

Sensors used: Temperature and humidity sensors
Computing platform used: AWS
Software used:VsCode-PlatformIO

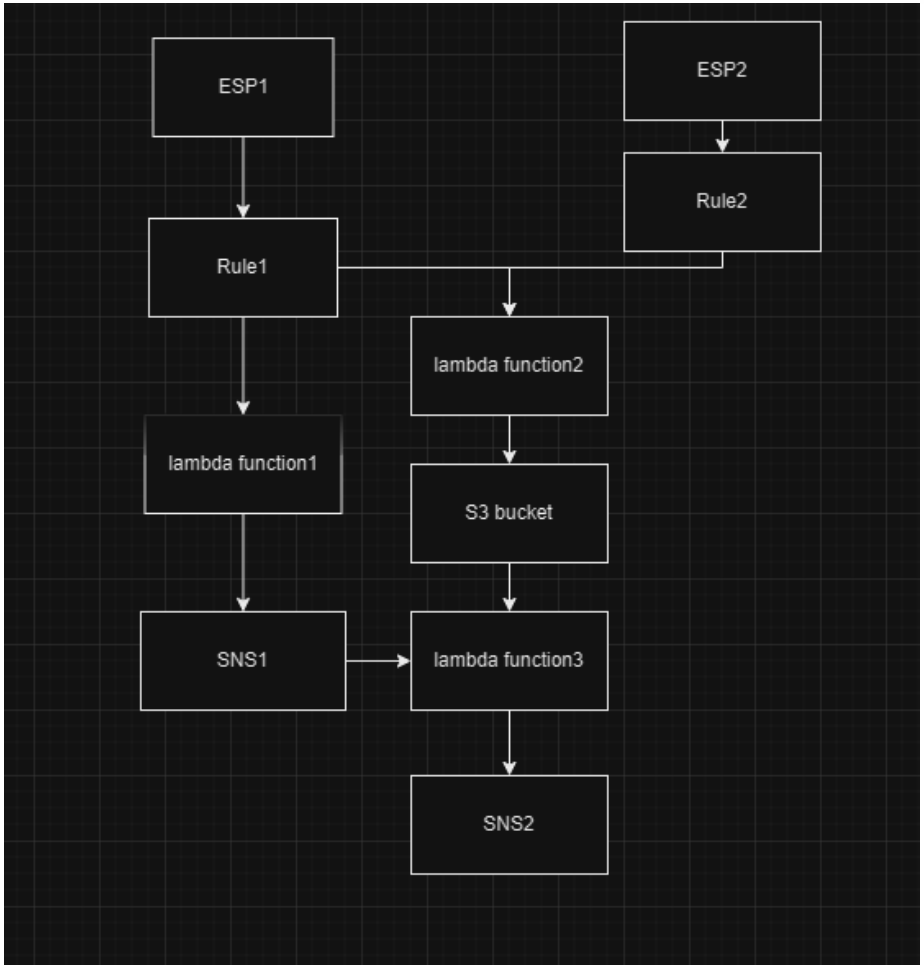
System Function

- When AWS receives a temperature above 70 degrees and a humidity below 30%, it sends an email warning to the manager to report the anomaly. After AWS sends out an alert, it compares the data collected by another ESP within a minute. If the difference in temperature and humidity is less than 10, It will continue to send emails alerting the factory to abnormal conditions. Judgment is made by secondary detection, thus avoiding false alarms due to certain malfunctions.

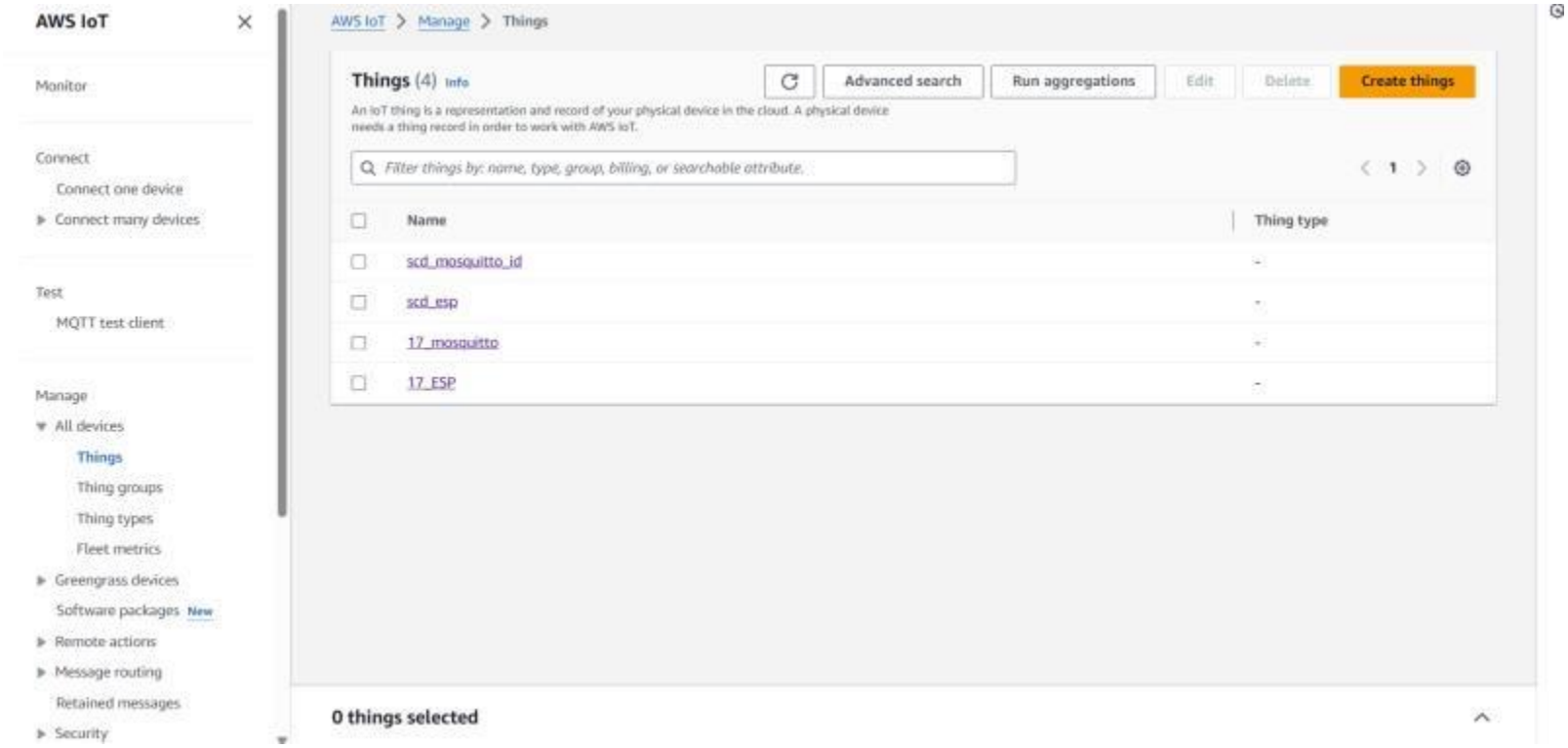


Network Structure

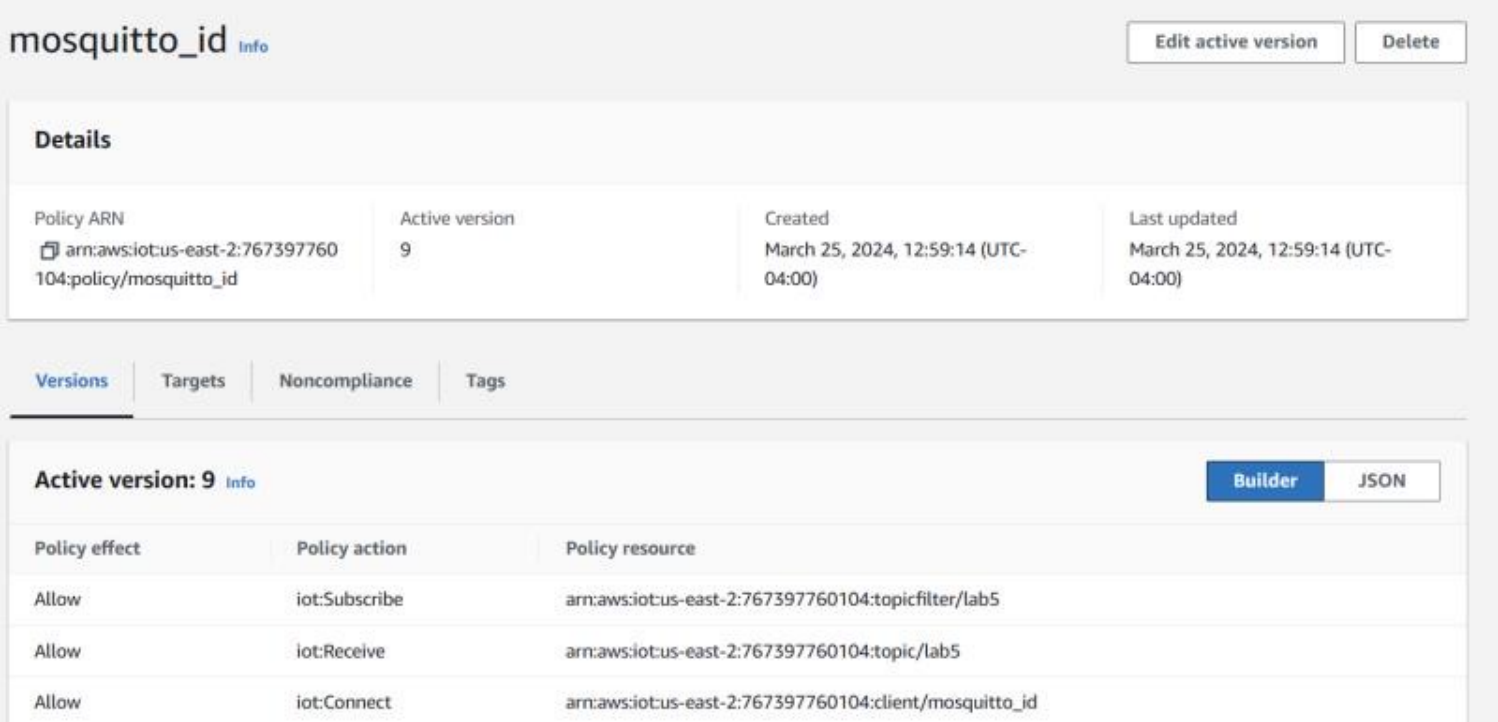
Solution



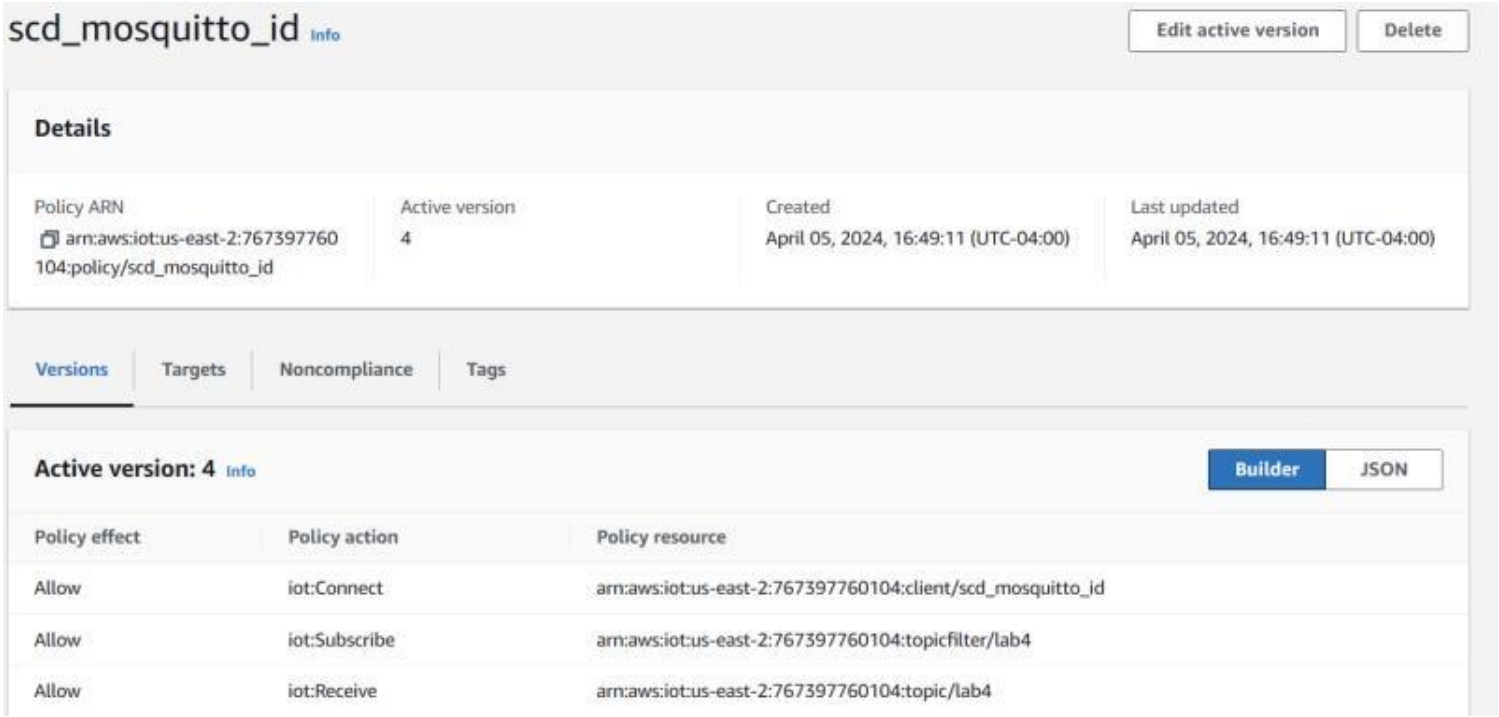
AWS Setup——Things



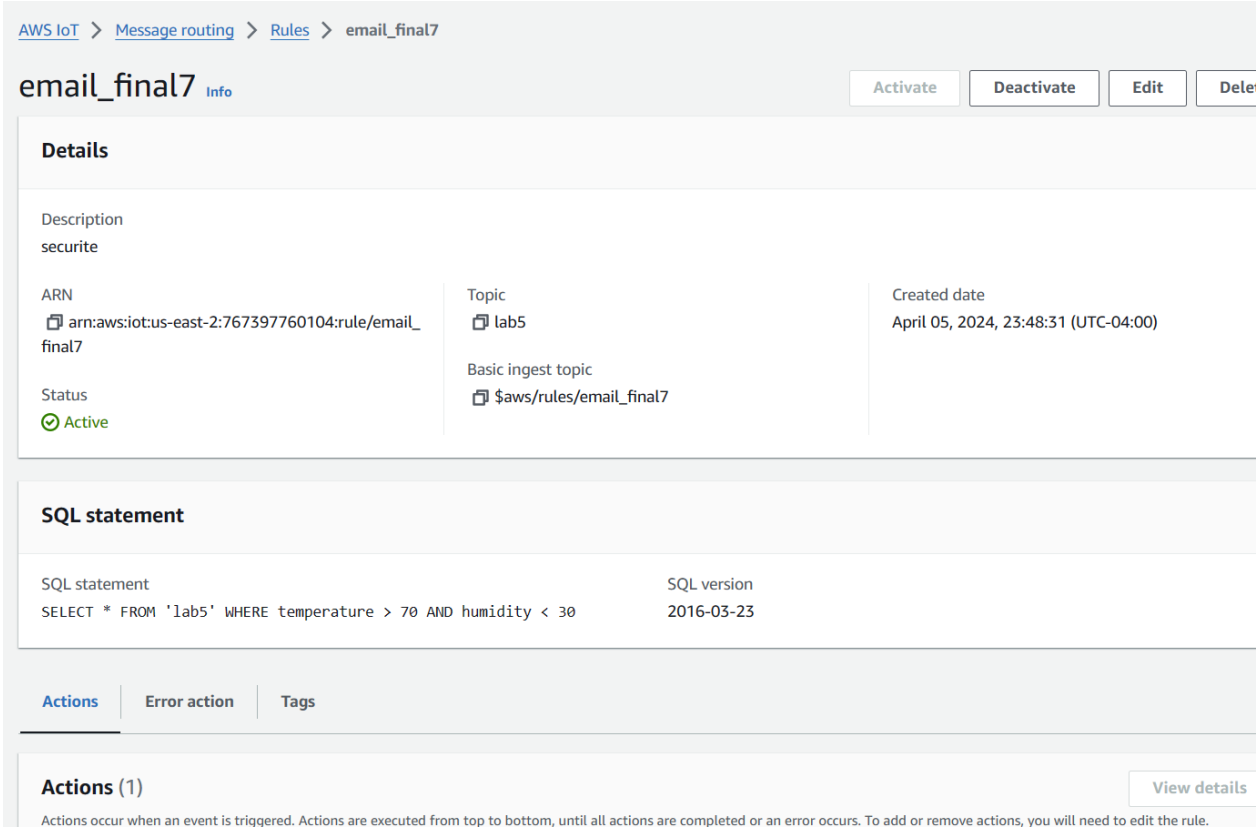
AWS Setup——Policy



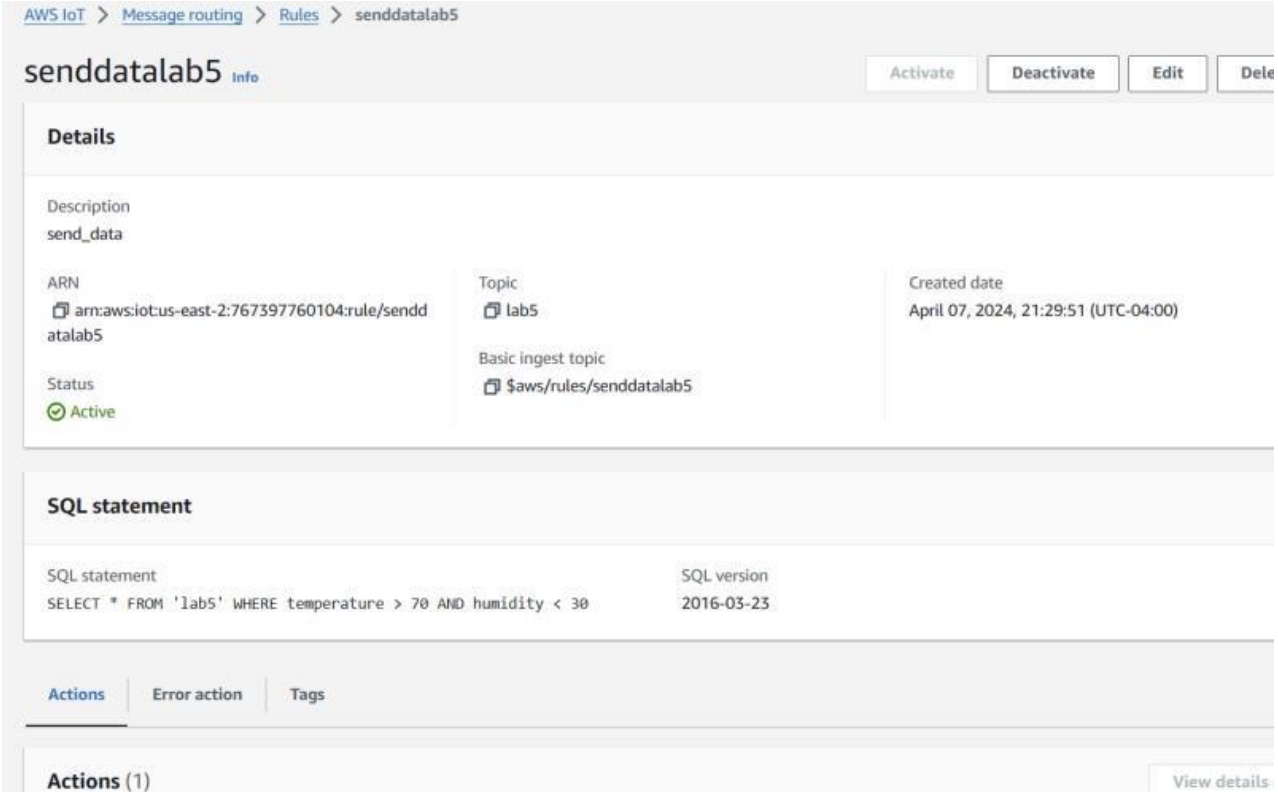
AWS Setup——Policy



AWS Setup——Rules



AWS Setup——Rules



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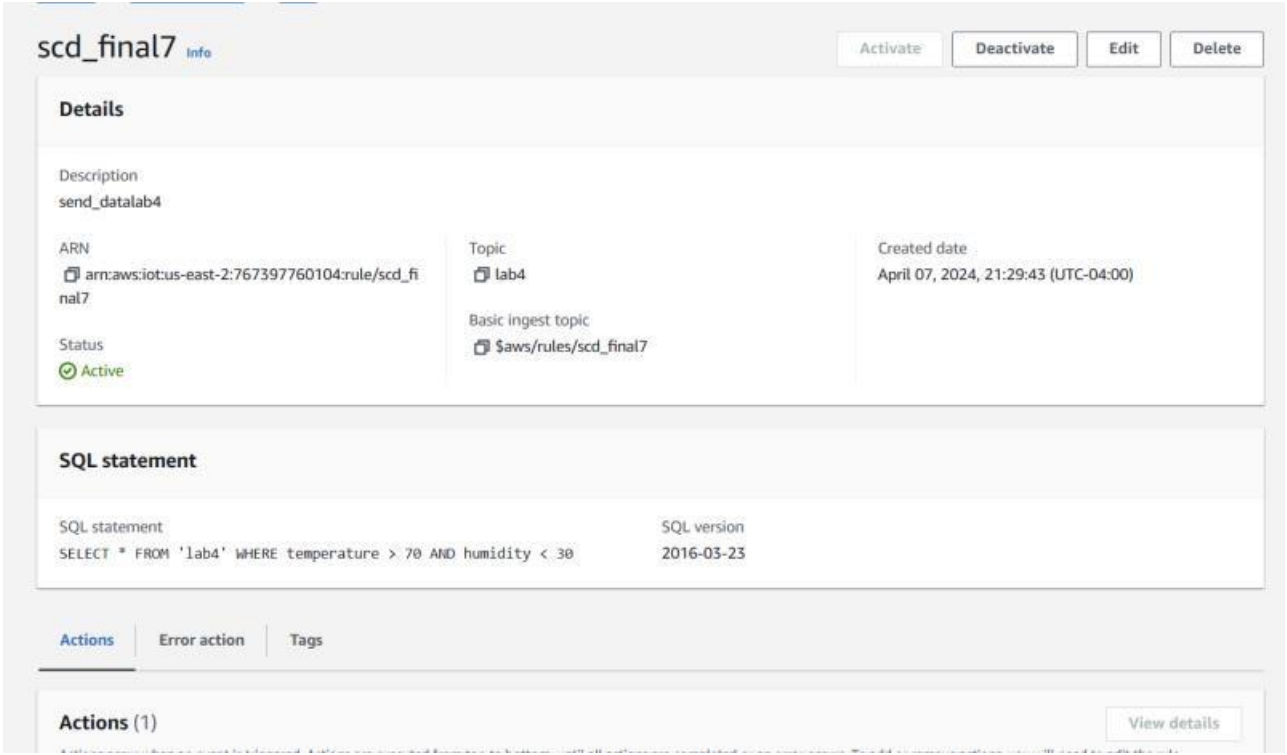

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Risk Assessment

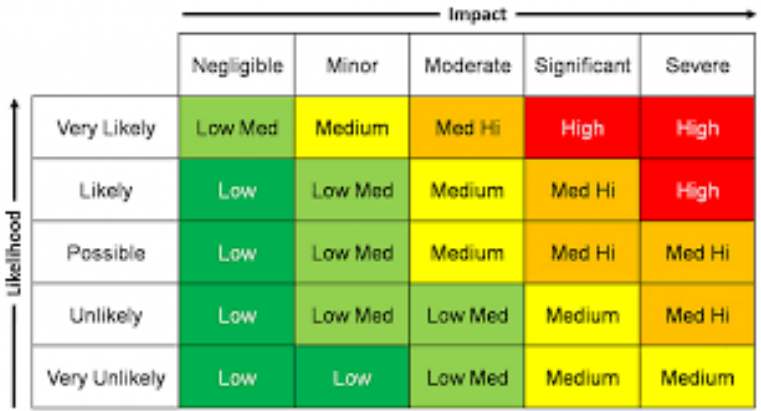
Initial Risk Assessment --- Methodology of scoring

Vulnerability Rating (1-5)	Description
1 - Very Low	The vulnerability is unlikely to be exploited within the next year.
2 - Low	The possibility exists that the vulnerability could be exploited at some point.
3 - Medium	There is a balanced chance of the vulnerability being exploited within the year.
4 - High	It is likely that the vulnerability will be exploited within the next year.
5 - Very High	The vulnerability is almost certain to be exploited within the next year.

Impact Rating (1-5)	Description
1 - Low	Minimal impact, slight inconvenience or minor costs.
2 - Low-Medium	Minor impact, causing noticeable but manageable effects.
3 - Medium	Moderate impact, measurable damage that is not severe.
4 - Medium-High	Significant impact, serious consequences that may require substantial resources.
5 - High	Major impact, causing major financial loss, legal repercussions, or severe damage to reputation.

Risk Score Calculation:
The Risk Score is calculated by multiplying the Likelihood(Vulnerability) Rating by the Impact Rating. The resulting score helps prioritize risks.

Risk categorization



- **Physical Risks:** Risks that involve physical damage to, or theft of, the IoT devices.
- **Communication Risks:** Risks associated with the transfer of data between devices and servers.
- **Cybersecurity Risks:** Risks related to unauthorized digital access to systems, such as hacking or malware.
- **Operational Risks:** Risks that impact the continued operation of the IoT system, including service disruption and data loss due to system malfunctions or configuration errors.

Risk Matrix

Risk ID	Risk Description	Likelihood (1-5)	Impact (1-5)	Risk Score (Likelihood x Impact)	Risk Type
R1	The factory experienced a power outage or power failure	2	5	10	Physical Risk
R2	Sensors aging leads to damage	2	5	10	
R3	Physical theft or tampering with esp32 boards	1	5	5	

Risk Matrix

Risk ID	Risk Description	Likelihood (1-5)	Impact (1-5)	Risk Score (Likelihood x Impact)	Risk Type
R4	Man-in-the-middle attacks during transmission to AWS	2	4	8	Communication risk
R5	SNS message spoofing	2	3	6	
R6	Data corruption in transit due to unreliable communication links	3	3	9	
R7	Wifi been attacked	3	4	12	

Risk Matrix

Risk ID	Risk Description	Likelihood (1-5)	Impact (1-5)	Risk Score (Likelihood x Impact)	Risk Type
R8	Protocols encryption leading to data leaks	3	4	12	Cybersecurity Risks
R9	Unencrypted Lambda invocations causing data breaches	2	5	10	
R10	Unauthorized access to AWS IoT rules leading to data mishandling	3	4	12	
R11	S3 bucket data hacked	3	5	15	
R12	Been DDoS attacked	3	4	12	

Risk Matrix

Risk ID	Risk Description	Likelihood (1-5)	Impact (1-5)	Risk Score (Likelihood x Impact)	Risk Type
R13	Lambda function errors leading to data loss	2	3	6	Operational Risks
R14	Lack of S3 bucket backup processes leading to data loss	1	4	4	
R15	AWS service disruption from overloading with messages	2	3	6	

3

Risk management

Risk mitigation

Risk mitigation refers to measures taken to reduce the likelihood of a potential risk occurring or to mitigate its impact on the organization. This strategy is aimed at identifying sources of risk and implementing preventive measures to reduce the likelihood of a risk or minimize its potential impact

Risk transference

Risk transference is the transfer of the financial impact of a potential risk from one organization to another. This is usually accomplished by purchasing insurance or transferring the risk to a third party through a contractual clause.

Risk acceptance

Risk acceptance is the decision, after assessing a risk, not to take any particular action to avoid, mitigate or transfer the risk. This is usually because the likelihood of the risk is low, the impact is limited, or because the cost of taking action outweighs the potential loss. In this case, the organization decides to accept the risk and prepare for possible negative impacts.

Risk management strategies

Risk ID	Risk Mitigation Strategy	Risk Transference Strategy	Risk Acceptance Decision
R1	Implement an Uninterruptible Power Supply (UPS) and backup generators. Regularly test backup power systems.	Purchase insurance for business interruption.	Accept the residual risk of power outage impacts after mitigation and transference strategies are applied.
R2	Regular maintenance and scheduled replacements based on sensors' expected lifespan.	Outsource sensor maintenance to vendors with liability clauses for faults.	Accept the residual risk that comes with the natural wear and tear of sensors.
R3	Install security cameras and alarms. Implement device tracking and remote disabling features.	Purchase insurance for theft and damages.	Accept the low likelihood of physical theft after physical security enhancements.
R4	Use end-to-end encryption for data in transit. Conduct regular security audits.	Utilize cloud services that offer shared security responsibility.	Accept a minimal risk of MITM attacks due to strong encryption protocols in place.

Risk management strategies

Risk ID	Risk Mitigation Strategy	Risk Transference Strategy	Risk Acceptance Decision
R5	Implement message authentication codes and verification processes for message integrity.	Employ third-party messaging services with indemnification clauses for spoofing incidents.	Accept the low-impact risk after implementing strong verification processes.
R6	Implement redundancy in communication channels and data validation protocols.	Contract with reliable service providers and consider service level agreements (SLAs) for uptime.	Accept minor communication inconsistencies that can be quickly resolved.
R7	Secure the WiFi network with strong encryption, regular password changes, and network monitoring.	Work with ISPs that offer DDoS protection and mitigation services.	Accept the risk of WiFi attacks as low probability due to strong network defenses.

Risk management strategies

Risk ID	Risk Mitigation Strategy	Risk Transference Strategy	Risk Acceptance Decision
R8	Ensure protocols and services have the latest encryption standards implemented.	Contract with third-party cybersecurity firms for additional protection layers.	Accept the risk after employing advanced encryption and regular security reviews.
R9	Enable encryption for all Lambda invocations and use AWS KMS for managing keys.	Obtain cyber liability insurance to cover potential data breach costs.	Accept the risk for non-sensitive data after encryption measures are in place.
R10	Apply the principle of least privilege for access to AWS IoT rules and enable detailed logging.	Use cloud services that provide breach responsibility and response services.	Accept minimal risk post-implementation of access controls and monitoring.
R11	Employ strict access controls, enable versioning, and use MFA for sensitive operations.	Utilize cloud-based security services with robust data protection guarantees.	Accept low residual risk given strong data protection and monitoring measures.

Risk management strategies

Risk ID	Risk Mitigation Strategy	Risk Transference Strategy	Risk Acceptance Decision
R12	Plan and implement a DDoS response strategy, including rate limiting and traffic filtering.	Invest in a Content Delivery Network (CDN) with DDoS mitigation capabilities.	Accept the risk due to proactive monitoring and a response plan to minimize downtime.
R13	Enforce strict error handling, logging, and automated rollback procedures in Lambda functions.	Engage with cloud service management firms for high reliability and error management.	Accept the risk when mitigation measures are in place to quickly rectify any issues.
R14	Introduce regular data backups, cross-region replication, and robust disaster recovery protocols.	Use third-party backup solutions and cloud storage with high durability guarantees.	Accept the risk for non-critical data and ensure critical data is regularly backed up.
R15	Implement API throttling, load balancing, and autoscaling for AWS services.	Choose cloud services with operational resilience and financial compensation for outages.	Accept some level of risk for message overloading, contingent on alerting and auto-scaling measures.

4

demonstration of project

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Thank You!

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