Environmental Monitoring

Phase 5

Date	01 November 2023
Team ID	NM2023TMID449
Project Name	Environmental Monitoring
Team Name	Proj_227236_Team_1

In this part you will document your project and prepare it for submission.

Document the Environmental Monitoring in Parks project and prepare it for submission.

Documentation

Describe the project's objectives, IoT device deployment, platform development, and code implementation.

Include diagrams, schematics, and screenshots of the IoT devices, environmental monitoring platform, and data display.

Explain how the real-time environmental monitoring system benefits park visitors and promotes outdoor activities.

Project Objectives:

The objectives and purposes of environmental monitoring are

Assessing environmental conditions and trends

Supporting policy development and its implementation

Developing information for reporting to national policymakers, international forums and the public

Measuring current conditions, spotting trends and changes, making forecasts and providing early risk warnings

Helping policymakers make informed decisions on sustainability and the environment

Managing and minimizing the impact an organization's activities have on an environment

Ensuring compliance with laws and regulations

IoT Device Architecture
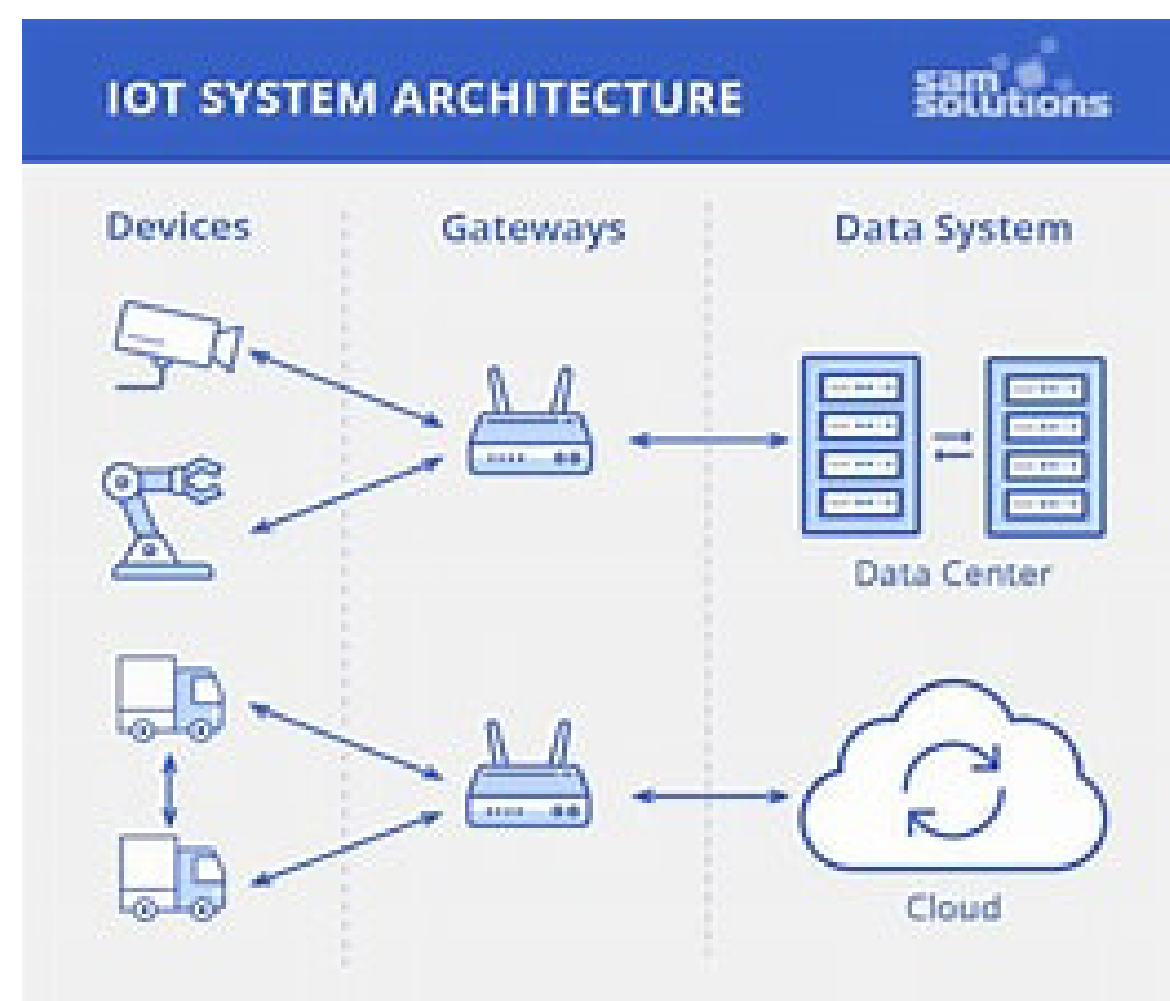
IoT Device Deployment:

IoT deployment is expanding out from consumer-based applications such as smart home devices and wearables to applications in the areas of public safety, emergency response, industrial automation, autonomous vehicles, and the Internet of Medical Things (IoMT). Many of these are mission-critical processes with life or death implications – so it's essential to get it right.

In this article, we'll be considering some strategies and best practices for IoT deployment, and looking at the challenges that must be overcome before, during, and after implementation.

A Three-Part Strategy for IoT Deployment:

Several factors come into the successful deployment of an IoT system and its connected devices, including security, interoperability, power or processing capabilities, scalability, and availability. A general strategy for implementation consists of three phases:

1. Consult:

Having determined whether you will buy your IoT infrastructure or build it out yourself, it's essential to first consult with the internal or external team responsible for running the project and establish a road map for your IoT deployment.

You'll also need to consider factors like your current state of readiness and what the project needs to return to justify its cost. Your "readiness assessment" should include calculations of cost, value, and ROI (Return On Investment).

At this stage, it may be a good idea to conduct a pilot program testing the validity of your ideas and providing a foundation for the strong business case you'll need to present to management when negotiating for the required project resources.

2. Develop:

During the development phase, you should optimize the initial plans created during the consultation, for performance, cost, and quickest route to market.

This is also the period during which you or your external contractors will be building out the cloud platform and setting up the analytics framework. These processes will typically involve configuring analytics, cognitive services, artificial intelligence (AI), and machine learning (ML) platforms to tackle features relevant to your business, and developing the interfaces for consumer-facing web platforms, applications, and data visualizations.

Consideration should also be given to device management, connectivity, and how these features will change during the life cycle of your IoT deployment.

3. Deploy:

The consultation phase should have yielded assurances that your development team or external contractors can install, support, and service all the necessary infrastructure and equipment during the crucial period of initial implementation.

The deployment phase marks the culmination of all your plans and provisions for security and data privacy, testing and enablement of interoperability, and forward stocking for backup hardware, customer support, technical support for Wi-Fi or cellular networks, gateways, web interfaces, apps, and your cloud platform.

Platform Development:

Internet of Things is no longer a newer concept. Undoubtedly, businesses and industries are widely accepting the Internet of Things systems. Thus, the practice of these high-tech IoT

platforms is rapidly increasing. You should have a keen knowledge of the IoT Development Platforms. It will help you to accomplish the Internet of Things product expansion.

Here, we have listed the 2 best IoT Development Platforms to fulfill the business needs.

1. Google Cloud IoT Platform:

The giant Techno company has used the IoT platforms for efficiency. According to Google, the Cloud Platform is the top part for encouraging IoT technology. Moreover, with the utmost security system, Google Cloud offers complete functioning effectively. Standing as one of the top Internet of Things Platforms, it offers various fascinating features. For example, robust A.I. aptitudes, Fast business procedures, Machine learning with vast capacity. Not only these, but the Google Cloud IoT also increases the work rate of the devices. This platform uses cloud amenities to lessen the cost and inspires location intelligence as well. They mainly focus on effective, fast, and efficient ways to run your business. In addition, the Google Cloud platform offers real-time understandings of devices used worldwide. This Google platform makes files maintenance and sharing easy. You can operate this IoT platform within any operating system without any problems.

2. Amazon Web Services Platform for IoT:

Another best Internet of Things Platform that is easily available currently. Amazon was the first and foremost company that uses the cloud as an IoT platform in the year 2004. Since that time, Amazon has put a lot of energy into building Amazon web services as the best IoT platform. This platform offers the most innovative and captivating features for its users. Also, they provide the most wide-ranging set of tools in the market. As it is easy and has a uniqueness in its properties, several companies use it throughout the world. Moreover,

because of IoT device management, you can easily connect and extend your devices. Amazon authorities have examined its versatility and adaptability properly. Therefore, they assure that this platform is safe and secure for the users.

Code Implementation :

Python script on the IoT devices to send real-time environmental data to the monitoring platform

```
"""

'temp_humidity.py'

==================================

Example of sending analog sensor values to an Adafruit IO feed.

Author(s): Brent Rubell

Tutorial Link: Tutorial Link:
https://learn.adafruit.com/adafruit-io-basics-temperature-and-humidity

Dependencies:

- Adafruit IO Python Client

(https://github.com/adafruit/io-client-python)

- Adafruit_Python_DHT

(https://github.com/adafruit/Adafruit_Python_DHT)
"""

# import standard python modules.

import time # import adafruit dht library.

import Adafruit_DHT # import Adafruit IO REST client.

from Adafruit_IO import Client, Feed
```

```python
# Delay in-between sensor readings, in seconds.
DHT_READ_TIMEOUT = 5
# Pin connected to DHT22 data pin
DHT_DATA_PIN = 26
# Set to your Adafruit IO key.
# Remember, your key is a secret,
# so make sure not to publish it when you publish this code!
ADAFRUIT_IO_KEY = 'YOUR_AIO_KEY'
# Set to your Adafruit IO username.
# (go to https://accounts.adafruit.com to find your username). ADAFRUIT_IO_USERNAME = 'YOUR_AIO_USERNAME'
# Create an instance of the REST client.
aio = Client (ADAFRUIT_IO_USERNAME, ADAFRUIT_IO_KEY)
# Set up Adafruit IO Feeds.
temperature_feed = aio.feeds('temperature')
humidity_feed = aio.feeds('humidity')
# Set up DHT22 Sensor. dht22_sensor = Adafruit_DHT.DHT22
while True:
    humidity, temperature = Adafruit_DHT.read_retry(dht22_sensor, DHT_DATA_PIN)
    if humidity is not None and temperature is not None:
        print('Temp={0:0.1f}*C Humidity={1:0.1f}%'.format(temperature, humidity))
        # Send humidity and temperature feeds to Adafruit IO
        temperature = '%.2f'%(temperature)
        humidity = '%.2f'%(humidity)
        aio.send(temperature_feed.key, str(temperature))
        aio.send(humidity_feed.key, str(humidity))
    else:
```

```
print('Failed to get DHT22 Reading, trying again in ',
DHT_READ_TIMEOUT, 'seconds')
# Timeout to avoid flooding Adafruit IO
time.sleep(DHT_READ_TIMEOUT)
```

Output:

```
Traceback (most recent call last):
  File "./prog.py", line 22, in <module>
ModuleNotFoundError: No module named 'Adafruit_DHT'
```

IoT-Based Temperature and Humidity Real-Time Monitoring

The Benefits of Real-Time Environmental Monitoring :

Some industries lose **tens of billions** each year because they cannot watch or control the temperature in their stock. This is only one fraction of the problem as a whole, though, as environmental monitoring is useful across many industries. If you work in one of these, how can such technology help you have the best results and what other benefits can you receive from its use?

Below, we will help you understand the advantages of environmental monitoring in your business. As you read through, consider how each benefit would help you increase your profits and prevent losses moving forward.

Benefits of real-time monitoring:

These are some of the most important ways in which real-time monitoring can help you with your work. This list is not exhaustive, though, and you may find other ways the technology can help you in your work.

More Accuracy

By having continuous monitoring of data, you can get a lot more information on the environments you monitor at more regular intervals. This stream of data allows you to make judgments on the state of whatever you are watching at all times. You can also make more robust decisions about changes you need to make to your processes, with a holistic view of what impact different events have.

Protecting Sensitive Environments

Sometimes, it may be hard to receive data from within an environment without stepping into it or otherwise disrupting it. This is especially the case in a wide-ranging area such as a large outdoor or indoor space. If you travel to the monitoring equipment, though, your very presence may disrupt the nature of the results you receive.

This may be due to an increase in light, or the movement of startled animals in the region. It could even change due to your body heat or pressure from outside changing airflow.

Instant Notifications

Ensuring you can react to problems as soon as they occur is one of the most important features you will need if trying to keep a consistent environment. For example, if you detect temperature changes, you can resolve them faster. In such cases, this might mean moving the items in question to different storage mediums or looking into what could cause the deviation.

Preventing Human Error

Monitoring an environment can play a huge role in ensuring you safeguard potential assets. These can include your data, stock, or anything else from human error. If you rely on your staff to check and update environments, there is every chance that inaccuracies may occur, such as:

Typos causing errors in data entry
Omissions of data due to negligence
Accidental errors
Malicious data entry
Delays in receiving important data

Compliance With Regulations

Depending on the industry you work in, you may find that your work involves adhering to many **different standards**. These might be recommendations set by your company. Then again, they could be legal regulations that could cause your business to receive fines if it does not follow them.

In some cases, failure to follow regulations means a whole research project might end up with invalid results. Or in an **industrial setting**, you might need to throw out batches of product due to spoilage.

Quality Control

Changes in the environment can often make a huge impact on the quality of products you create. There is almost a limitless number of things that can cause unwanted changes during a production process. As such, you need to have control of these to get the best results.

By having information on the status of any environment, you can make adjustments yourself as things change. You can even do this automatically with the right software.

By combining the results from monitoring with control systems, you can ensure it remains perfect for whatever you need at all times.

Easier Analytics

Any sort of machine-learning algorithm is only as good as the data you get it. As such, by using automated electronically-collected data, it is much more likely you can get an AI to look at it for patterns. The possibilities for this are many, including.

Creating predictive models for future planning
Optimizing the environment and how you maintain it

Discovering unexpected relationships between environmental factors