

# AeroSense: Phase 5 Documentation

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**Phase Title:** Apex Programming (Developer)

**Objective:** To extend AeroSense functionality beyond declarative tools by using **Apex classes, triggers, SOQL, SOSL, and asynchronous processes** for real-time air quality monitoring.

## 1. Apex Classes & Objects

- **SensorHandler.cls** → Handles sensor logic (status updates, calibration).
- **ReadingHandler.cls** → Processes air quality readings (AQI calculation).
- **AlertService.cls** → Manages creation and notification of alerts.
- **AggregateBatch.cls** → Summarizes daily AQI values using Batch Apex.

## 2. Apex Trigger Example: Auto-Create Alert

Trigger on **Reading\_\_c** to auto-generate an alert when AQI exceeds 150.

```
trigger ReadingTrigger on Reading__c (after insert) {  
    for (Reading__c r : Trigger.new) {  
        if (r.AQI__c > 150) {  
            Alert__c alert = new Alert__c(  
                Sensor__c = r.Sensor__c,  
                Reading__c = r.Id,  
                Severity__c = 'High',  
                Message__c = 'AQI exceeds safe threshold: ' + r.AQI__c  
            );  
            insert alert;  
        }  
    }  
}
```

```
}  
}
```

### 3. Trigger Design Pattern (Handler Class)

Best practice: delegate logic to a **Handler Class**.

```
trigger ReadingTrigger on Reading__c (after insert) {  
    ReadingHandler.createAlerts(Trigger.new);  
}
```

```
public class ReadingHandler {  
    public static void createAlerts(List<Reading__c> readings) {  
        List<Alert__c> alerts = new List<Alert__c>();  
        for (Reading__c r : readings) {  
            if (r.AQI__c > 150) {  
                alerts.add(new Alert__c(  
                    Sensor__c = r.Sensor__c,  
                    Reading__c = r.Id,  
                    Severity__c = 'High',  
                    Message__c = 'Critical AQI detected: ' + r.AQI__c  
                ));  
            }  
        }  
        if (!alerts.isEmpty()) {  
            insert alerts;  
        }  
    }  
}
```

}

Q. apex

Apex Exception Email

Apex Classes

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**Apex Class Detail**

Name: ReadingHandler

Namespace Prefix:

Created By: Raksha Kalaskar, 9/22/2025, 9:59 AM

Status: Active

Code Coverage: 0% (0/23)

Last Modified By: Raksha Kalaskar, 9/22/2025, 9:59 AM

Class Body | Class Summary | Version Settings | Trace Flags

```
1 public with sharing class ReadingHandler {
2
3     // Very simple AQI placeholder calculation (replace with a proper formula if needed)
4     public static Decimal calculateAQI(Decimal pm25, Decimal pm10) {
5         if (pm25 == null) pm25 = 0;
6         // placeholder: use PM2.5 as AQI proxy (round)
7         return pm25.setScale(0);
8     }
9
10    // Process a list of new/updated readings (called from trigger)
11    public static void processNewReadings(List<Reading__c> readings) {
12        if (readings == null || readings.isEmpty()) return;
13
14        List<Alert__c> alertsToInsert = new List<Alert__c>();
15
16        // If this is called in after insert, reading id is available
17        for (Reading__c r : readings) {
18            // Compute AQI if null
19            if (r.AQI__c == null) {
20                Decimal calc = calculateAQI(r.PM2_5__c, r.PM10__c);
21                // We cannot update Trigger.new directly in after context, for simplicity create alert based on calc
22                r.AQI__c = calc;
23            }
24
25            // If AQI breach -> prepare alert
26            if (r.AQI__c != null && (r.AQI__c > 150)) {
27                Alert__c a = new Alert__c();
28                a.Sensor__c = r.Sensor__c;
```

## 4. SOQL Example

Fetch sensors with their latest readings:

```
List<Sensor__c> sensors = [
```

```
    SELECT Id, Name, Trust_Score__c,
```

```
        (SELECT AQI__c, Timestamp__c FROM Readings__r ORDER BY Timestamp__c DESC LIMIT 1)
```

```
FROM Sensor__c
```

```
];
```

## 5. SOSL Example

Search for sensors or alerts with the keyword "Critical":

```
List<List<SObject>> results = [FIND 'Critical' IN ALL FIELDS RETURNING Alert__c(Name,
Message__c), Sensor__c(Name)];
```

## 6. Collections (List, Set, Map)

```
List<Reading__c> readings = [SELECT AQI__c FROM Reading__c];
```

```
Set<Integer> uniqueAQI = new Set<Integer>();
```

```
Map<Id, Sensor__c> sensorMap = new Map<Id, Sensor__c>([SELECT Id, Name FROM
Sensor__c]);
```

## 7. Asynchronous Processing

### Batch Apex – Daily AQI Aggregation

```
global class AggregateBatch implements Database.Batchable<SObject> {

    global Database.QueryLocator start(Database.BatchableContext bc) {

        return Database.getQueryLocator('SELECT Id FROM Sensor__c');

    }

    global void execute(Database.BatchableContext bc, List<Sensor__c> sensors) {

        List<DailyAggregate__c> aggregates = new List<DailyAggregate__c>();

        for (Sensor__c s : sensors) {

            AggregateResult[] results = [

                SELECT AVG(AQI__c) avgAQI, MAX(AQI__c) maxAQI, MIN(AQI__c) minAQI

                FROM Reading__c WHERE Sensor__c = :s.Id AND

                    DAY_ONLY(Timestamp__c) = TODAY

            ];

            if (!results.isEmpty()) {

                aggregates.add(new DailyAggregate__c(

                    Sensor__c = s.Id,

                    Date__c = Date.today(),

                    Avg_AQI__c = (Decimal)results[0].get('avgAQI'),

                    Max_AQI__c = (Decimal)results[0].get('maxAQI'),

                    Min_AQI__c = (Decimal)results[0].get('minAQI')

                ));

            }

        }

    }

}
```

```

    }

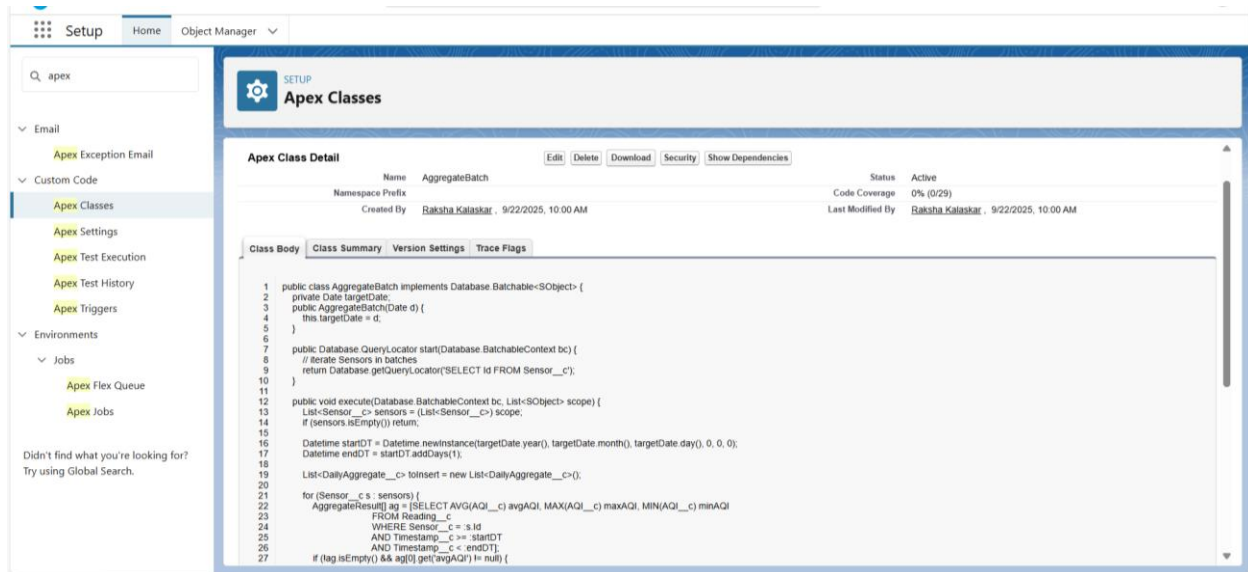
    if (!aggregates.isEmpty()) insert aggregates;

}

global void finish(Database.BatchableContext bc) {}

}

```



## 8. Future Method Example (Async Call)

```

public class NotificationService {

    @future

    public static void sendAsyncEmail(String email, String message) {

        Messaging.SingleEmailMessage mail = new Messaging.SingleEmailMessage();

        mail.setToAddresses(new String[]{email});

        mail.setSubject('AeroSense Alert');

        mail.setPlainTextBody(message);

        Messaging.sendEmail(new Messaging.SingleEmailMessage[]{mail});

    }
}

```

}

The screenshot displays the Salesforce Developer Console interface. The top navigation bar includes tabs for 'Recently Viewed', 'Apex Classes', 'Apex Test Editor', and 'Developer Console'. The address bar shows the URL: `https://orgfarm-9aa573cd4a-dev-ed.develop.my.salesforce.com/_u...`. The console window has a menu bar with 'File', 'Edit', 'Debug', 'Test', 'Workspace', and 'Help'. Below the menu bar, there are three tabs: 'eAnonymous @9/22/2025, 10:42:34 PM', 'NotificationService.apxc', and 'Log executeAnonymous @9/22/2025, 10:44:14 PM'. The 'Log executeAnonymous' tab is active, showing the 'Execution Log'.

The 'Execution Log' table has three columns: 'Timestamp', 'Event', and 'Details'. It lists various events such as 'USER\_INFO', 'EXECUTION\_START', 'CODE\_UNIT\_START', and multiple 'HEAP\_ALLOCATE' events with their respective memory addresses and sizes. The log is filtered to show only the events for the 'executeAnonymous' process.

Below the 'Execution Log' is a toolbar with checkboxes for 'This Frame', 'Executable', 'Debug Only', and 'Filter', along with a 'Click here to filter the log' button. Below the toolbar is a tabbed interface with 'Logs', 'Tests', 'Checkpoints', 'Query Editor', 'View State', 'Progress', and 'Problems'. The 'Logs' tab is active, showing a table of log entries.

The 'Logs' table has columns: 'User', 'Application', 'Operation', 'Time', 'Status', 'Read', and 'Size'. It lists several log entries for 'Raksha Kalaskar' with various operations and statuses. The 'Logs' tab is selected, and the 'Filter' button is visible at the bottom.

Timestamp	Event	Details
22:44:14:000	USER_INFO	[EXTERNAL] 005gL000005HgSz rakshakalaskar2598372@agentforce.com (GMT-07:00) Pacific Daylight Time (/
22:44:14:000	EXECUTION_ST...	
22:44:14:000	CODE_UNIT_ST...	[EXTERNAL] execute_anonymous_apex
22:44:14:000	HEAP_ALLOCATE	[95] Bytes:3
22:44:14:000	HEAP_ALLOCATE	[100] Bytes:152
22:44:14:000	HEAP_ALLOCATE	[417] Bytes:408
22:44:14:000	HEAP_ALLOCATE	[430] Bytes:408
22:44:14:000	HEAP_ALLOCATE	[317] Bytes:6
22:44:14:000	HEAP_ALLOCATE	[EXTERNAL] Bytes:1
22:44:14:001	STATEMENT_EX...	[1]
22:44:14:001	STATEMENT_EX...	[1]
22:44:14:001	HEAP_ALLOCATE	[1] Bytes:19
22:44:14:001	HEAP_ALLOCATE	[1] Bytes:14
22:44:14:001	HEAP_ALLOCATE	[1] Bytes:4
22:44:14:001	HEAP_ALLOCATE	[1] Bytes:19
22:44:14:001	HEAP_ALLOCATE	[1] Bytes:26
22:44:14:001	HEAP_ALLOCATE	[1] Bytes:4
22:44:14:001	HEAP_ALLOCATE	[1] Bytes:6
22:44:14:001	HEAP_ALLOCATE	[68] Bytes:5

User	Application	Operation	Time	Status	Read	Size
Raksha Kalaskar	Unknown	FutureHandler	9/22/2025, 10:4...	Success	Unread	3.8 KB
Raksha Kalaskar	Unknown	/services/data/v...	9/22/2025, 10:4...	Success		2.25 KB
Raksha Kalaskar	Unknown	/services/data/v...	9/22/2025, 10:4...	Success		5.98 KB
Raksha Kalaskar	Unknown	ApexTestHandler	9/22/2025, 10:4...	Insert failed. Fir...		9.92 KB
Raksha Kalaskar	Unknown	ApexTestHandler	9/22/2025, 10:4...	Insert failed. Fir...	Unread	14.39 KB
Raksha Kalaskar	Unknown	ApexTestHandler	9/22/2025, 10:4...	Insert failed. Fir...	Unread	12.33 KB

## 9. Exception Handling Example

```
try {  
  
    insert new Alert__c(Name='Test');
```

```
} catch (DmlException e) {  
    System.debug('Error creating alert: ' + e.getMessage());  
}
```

## 10. Test Class Example

@isTest

```
public class ReadingHandlerTest {
```

```
    @isTest
```

```
    static void testCreateAlert() {
```

```
        Sensor__c s = new Sensor__c(Name='Test Sensor');
```

```
        insert s;
```

```
        Reading__c r = new Reading__c(Sensor__c = s.Id, AQI__c = 200);
```

```
        insert r;
```

```
        List<Alert__c> alerts = [SELECT Id FROM Alert__c WHERE Sensor__c = :s.Id];
```

```
        System.assertEquals(1, alerts.size());
```

```
    }
```

```
}
```

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https://orgfarm-9aa573cd4a-dev-ed.develop.my.salesforce.com/\_ui/common/apex/debug/ApexCSIPage

File Edit Debug Test Workspace Help

Log executeAnonymous @9/22/2025, 10:40:07 PM

### Execution Log

Timestamp	Event	Details
22:40:07:002	USER_INFO	[EXTERNAL]005gl.000005HgSz[rakshakalaskar2598372@agentforce.com](GMT-07:00) Pacific Daylight Time (America/Los_Angeles)(GMT-07:00)
22:40:07:002	EXECUTION_ST...	
22:40:07:002	CODE_UNIT_ST...	[EXTERNAL]01pgl.000005cUNB[SensorSharingServiceTest.testSharing()]
22:40:07:008	HEAP_ALLOCATE	[95]]Bytes:3
22:40:07:008	HEAP_ALLOCATE	[100]]Bytes:152
22:40:07:008	HEAP_ALLOCATE	[417]]Bytes:408
22:40:07:008	HEAP_ALLOCATE	[430]]Bytes:408
22:40:07:008	HEAP_ALLOCATE	[317]]Bytes:6
22:40:07:008	HEAP_ALLOCATE	[EXTERNAL]]Bytes:24
22:40:07:008	METHOD_ENTRY	[2]]01pgl.000005cUNB[SensorSharingServiceTest.SensorSharingServiceTest()]
22:40:07:008	STATEMENT_EX...	[2]]
22:40:07:008	STATEMENT_EX...	[2]]
22:40:07:008	METHOD_EXIT	[2]]SensorSharingServiceTest
22:40:07:008	HEAP_ALLOCATE	[68]]Bytes:5
22:40:07:008	HEAP_ALLOCATE	[74]]Bytes:5
22:40:07:008	HEAP_ALLOCATE	[83]]Bytes:7
22:40:07:008	STATEMENT_EX...	[4]]
22:40:07:008	STATEMENT_EX...	[6]]
22:40:07:008	HEAP_ALLOCATE	[6]]Bytes:4
22:40:07:009	HEAP_ALLOCATE	[6]]Bytes:11

☐ This Frame ☐ Executable ☐ Debug Only ☐ Filter Click here to filter the log

### Logs

User	Application	Operation	Time	Status	Read	Size
Raksha Kalaskar	Unknown	ApexTestHandler	9/22/2025, 10:40:07 PM	Insert failed. First exception on row 0;...		9.92 KB
Raksha Kalaskar	Unknown	ApexTestHandler	9/22/2025, 10:40:04 PM	Insert failed. First exception on row 1;...	Unread	14.39 KB
Raksha Kalaskar	Unknown	ApexTestHandler	9/22/2025, 10:40:04 PM	Insert failed. First exception on row 0;...	Unread	12.33 KB
Raksha Kalaskar	Browser	/ui/setup/apex/batch/ScheduleBatchA...	9/22/2025, 10:36:57 PM	Success	Unread	1.38 KB
Raksha Kalaskar	Browser	/setup/build/1stApexClass.apex	9/22/2025, 10:35:47 PM	Success	Unread	631 bytes
Raksha Kalaskar	Unknown	ApexTestHandler	9/22/2025, 10:34:48 PM	Insert failed. First exception on row 1;...	Unread	14.41 KB

☐ Filter Click here to filter the log list

Setup Home Object Manager

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## Apex Classes

### AlertService

Apex Class

AlertService

Edit Delete Download Security Show Dependencies

Name	Status	Active
AlertService		

Namespace Prefix	Code Coverage
	0% (0/28)

Created By	Last Modified By
Raksha Kalaskar, 9/22/2025, 9:58 AM	Raksha Kalaskar, 9/22/2025, 9:58 AM

Class Body Class Summary Version Settings Trace Flags

```
1 public with sharing class AlertService {
2
3     // Create an Alert__c record from a reading and notify (email)
4     public static Alert__c createAlertFromReading(Reading__c r) {
5         if (r == null) return null;
6         Alert__c a = new Alert__c();
7         a.put('Sensor__c', r.Sensor__c);
8         a.put('Reading__c', r.Id);
9         a.put('Severity__c', 'High');
10        a.put('Message__c', 'ACI exceeds safe limit: ' + String.valueOf(r.AQI__c));
11        if (Schema.sObjectType.Alert__c.fields.getMap().containsKey('Triggered_Alert__c')) {
12            a.put('Triggered_Alert__c', Datetime.now());
13        }
14        insert a;
15
16        notifyMonitoringTeam(a);
17        return a;
18    }
19
20    // Simple email notification (developer org: sends to current user's email as fallback)
21    public static void notifyMonitoringTeam(Alert__c a) {
22        if (a == null) return;
23        // Build email list - try to find org admin, else fallback to current user
```