Project 4 – Task 2 Writeup

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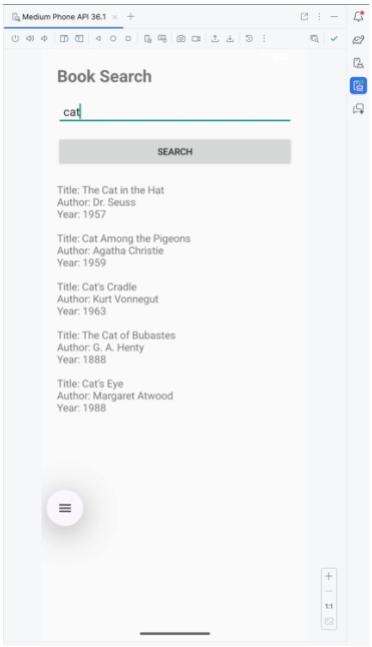
1. Android Native Application

My Android application implements a fully native mobile client that meets all requirements of Task 2.

1. Uses at least three different Android Views

My UI contains:

- **TextView** – displays labels and results
- **EditText** – for entering search keywords
- **Button** – triggers the search request



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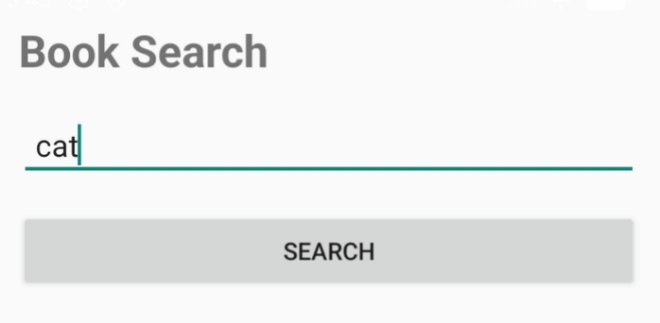
2. Accepts user input

Users type any book keyword into the EditText field.
Example above:

```
Cat
```



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3. Sends HTTP request to my servlet

When the user presses *SEARCH*, the app builds this URL:

```
try {
    String apiUrl = "https://ubiquitous-pancake-v6794gx9r9vrfw7jq-8080.app.github.dev/books?keyword="
            + keyword;
```

and sends a GET request using `HttpURLConnection`.

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4. Parses structured JSON

The app receives JSON array results such as:

```
[
  {"title": "The Cat in the Hat", "author": "Dr. Seuss", "firstPublishYear":
1957},
  ...
]
```

I parse it using:

```
JSONArray arr = new JSONArray(response);
```

and extract each field into formatted text.

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5. Displays results in the app

The first 5 books are shown with:

- Title
- Author
- Year

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6. App is reusable

Users can repeatedly change the search keyword and press SEARCH again without restarting the application. I demo this function using “Cat” and “Dog” in the video I uploaded.

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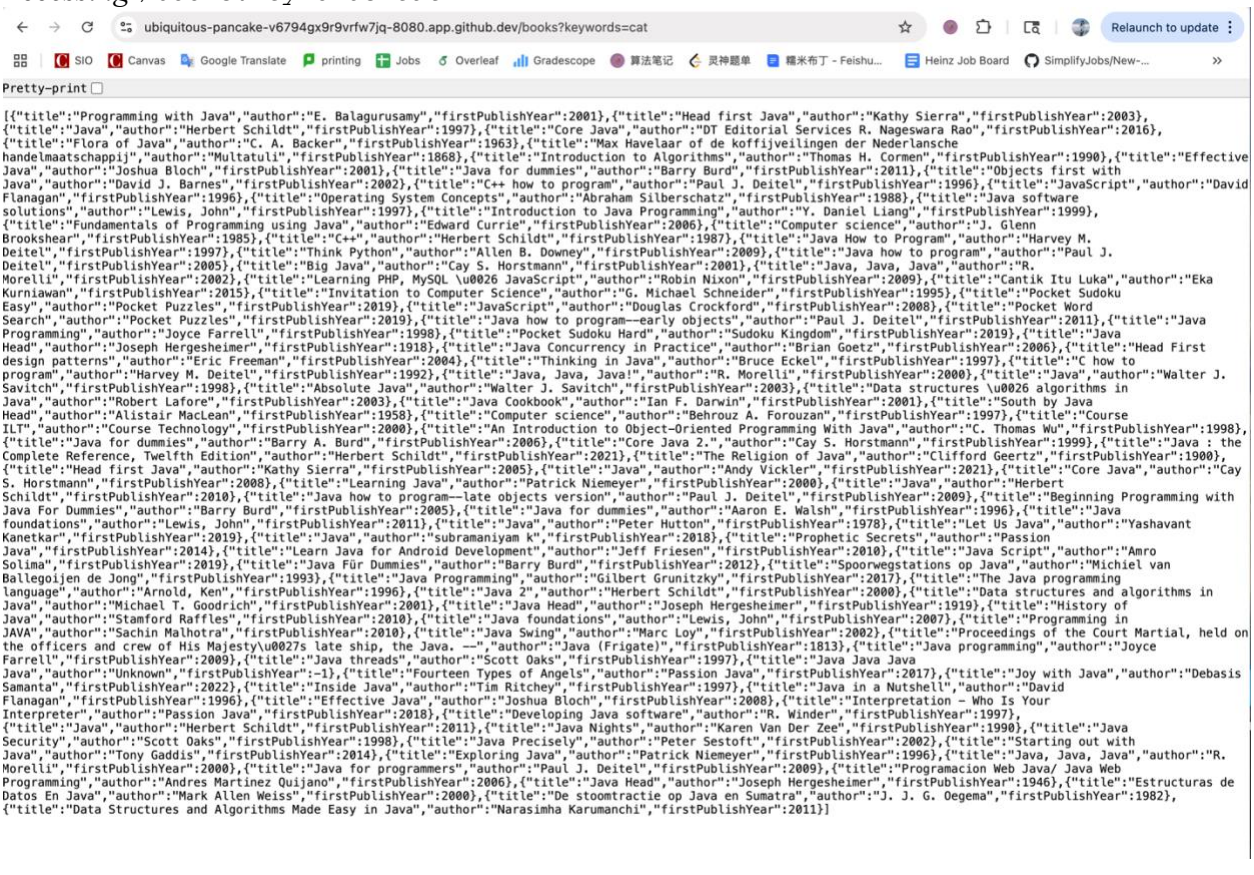
2. Web Service

My backend service is written **entirely using Java Servlets**, not JAX-RS, satisfying CMU Task 2 requirements.

Servlets Implemented

Servlet	Path	Purpose
BookServlet	`/books`	Receives Android keyword and returns filtered JSON
DashboardServlet	`/dashboard`	Displays analytics + log table in JSP
TestServlet	`/TestServlet`	Simple connectivity test

Accessing `/books?keywords=cat`



Processing pipeline

1. Receive Android request (`keyword`)
2. Call **third-party book API**
3. Measure API latency

4. Parse JSON response
5. Filter fields → return clean JSON array with only:
    - title
    - author
    - firstPublishYear
6. Write operational log to MongoDB
7. Return JSON to client

Third-Party API Integration

My servlet uses a real external API:

`https://openlibrary.org/search.json?q=<keyword>`

What I extract from API:

- `title`
- `author_name[0]`
- `first_publish_year`

These are the only fields returned to Android, which satisfies:

"Do not return unnecessary fields."

```
try {
    // 1. OpenLibrary API
    String apiURL = "https://openlibrary.org/search.json?q=" + keyword;

    long apiStart = System.currentTimeMillis();

    URL url = new URL(apiURL);
    HttpURLConnection conn = (HttpURLConnection) url.openConnection();
    conn.setConnectTimeout(8000);
    conn.setReadTimeout(8000);
    conn.setRequestMethod("GET");

    BufferedReader br = new BufferedReader(new InputStreamReader(conn.getInputStream()));
    StringBuilder sb = new StringBuilder();
    String line;

    while ((line = br.readLine()) != null) sb.append(line);

    br.close();
    conn.disconnect();

    apiLatency = System.currentTimeMillis() - apiStart;
    LOGGER.info( msg: "API latency = " + apiLatency + " ms");

    // 2. Parse response JSON
    Type type = new TypeToken<BookResponse>() {}.getType();
    BookResponse r = gson.fromJson(sb.toString(), type);

    List<Book> books = r.toSimpleList();
    resultCount = books.size();
    LOGGER.info( msg: "resultCount = " + resultCount);
```

```
// 3. Insert books into MongoDB
try {
    for (Book b : books) {
        Document doc = new Document()
                .append("title", b.title)
                .append("author", b.author)
                .append("firstPublishYear", b.firstPublishYear)
                .append("keyword", keyword)
                .append("savedAt", System.currentTimeMillis());
        MongoUtil.getBookCollection().insertOne(doc);

    }
} catch (Exception e) {
    LOGGER.severe( msg: "Mongo insert ERROR: " + e.getMessage());
}

// 4. Send output
out.println(gson.toJson(books));
out.flush();
```

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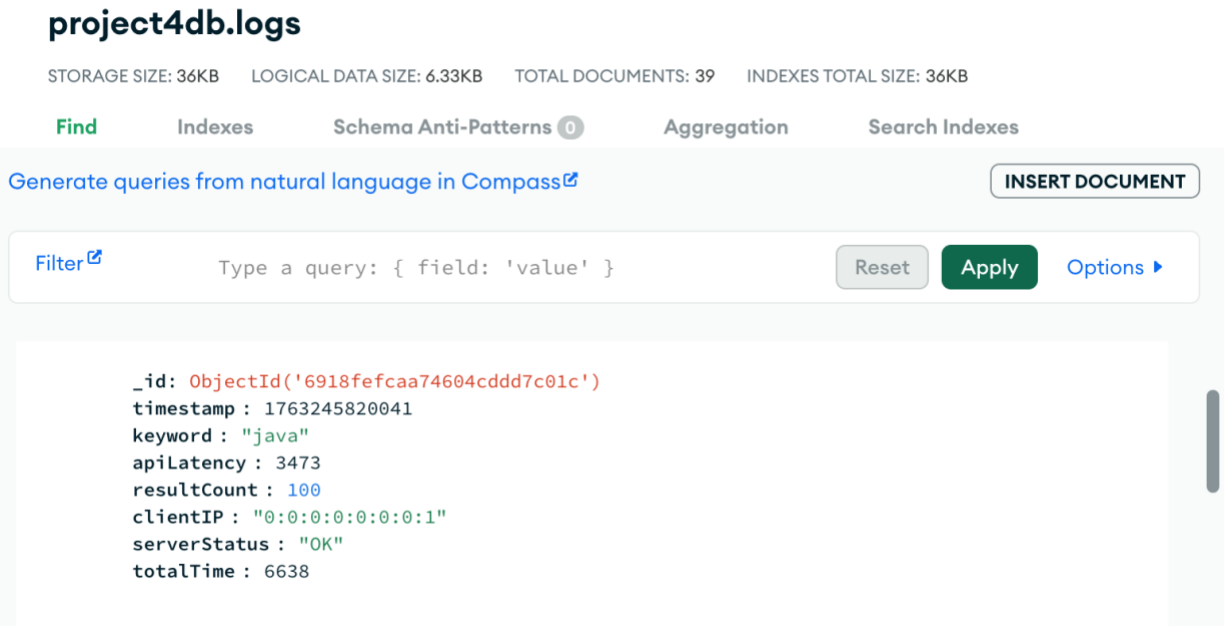
4. Logging

For each Android request handled by the web service, I log the following **6+ required fields**:

Field	Description
timestamp	UNIX epoch of request
keyword	User search keyword
apiLatency	Time to fetch from third-party API
resultCount	Number of books returned
clientIP	Android device's IP (Codespace proxy IP)
serverStatus	“OK” or “ERROR”
totalTime	End-to-end total servlet processing time

All logs are written using the MongoDB Java driver.



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5. MongoDB Atlas Storage

I created a free MongoDB Atlas cluster named **Cluster0**.

Collections used:

- `project4db.logs` — operational logs

- `project4db.books` — test collection (optional)

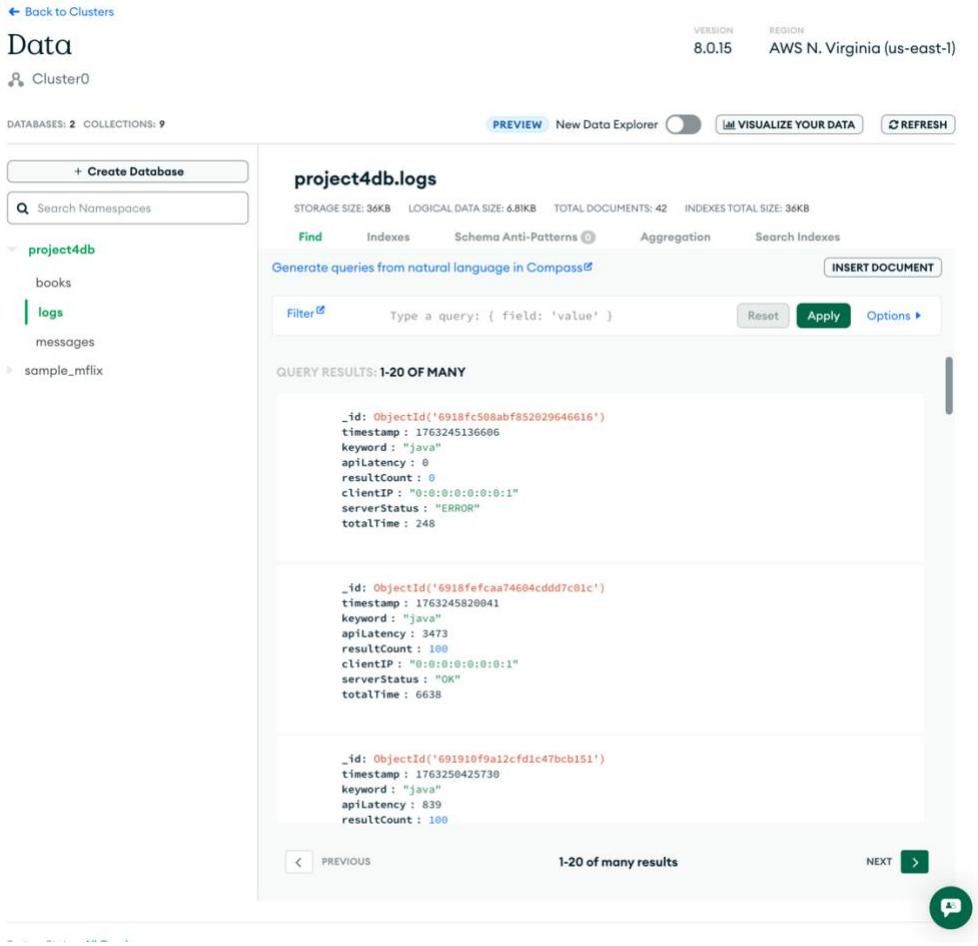
Connection method:

I use the connection string:

```
"mongodb+srv://sherryzh:<db_password>@cluster0.qscaoz4.mongodb.net/?appName=Cluster0";
```

Code fragment (Java)

```
MongoClient client = MongoClients.create(connectionString);
MongoDatabase db = client.getDatabase("project4db");
MongoCollection<Document> logs = db.getCollection("logs");
logs.insertOne(logDoc);
```



6. Web Dashboard (JSP + Servlet)

My dashboard is available at:

`/dashboard`

and implemented using:

- **DashboardServlet**
- **dashboard.jsp**

The dashboard provides the required analytics:

✓ Total Requests

✓ Success vs Error count

✓ Average API latency

✓ Top search keywords (computed in servlet)

✓ Complete log table (formatted HTML table)

Project 4 Operations Dashboard

Analytics Summary

Total Requests: 41

Success: 39

Error: 2

Average API Latency: 1366.6829268292684 ms

Top Keywords

- java — 14 searches
- cat — 6 searches
- dog — 5 searches
- love — 4 searches
- like — 2 searches

Request Logs

Timestamp	Keyword	API Latency	Result Count	Client IP	Status	Total Time
1763245136606	java	0	0	0:0:0:0:0:0:0:1	ERROR	248
1763245820041	java	3473	100	0:0:0:0:0:0:0:1	OK	6638
1763250425730	java	839	100	0:0:0:0:0:0:0:1	OK	4149
1763250504897	java	833	100	0:0:0:0:0:0:0:1	OK	3308
1763250513246	love	5368	100	0:0:0:0:0:0:0:1	OK	7756
1763250598529	java	703	100	0:0:0:0:0:0:0:1	OK	3272
1763250605932	(*@	291	0	0:0:0:0:0:0:0:1	OK	292
1763250623965	java	0	0	0:0:0:0:0:0:0:1	ERROR	3
1763250920585	java	851	100	0:0:0:0:0:0:0:1	OK	4115
1763250931765	love	1484	100	0:0:0:0:0:0:0:1	OK	4013
1763251494594	java	870	100	0:0:0:0:0:0:0:1	OK	4770
1763267861301	java	760	100	0:0:0:0:0:0:0:1	OK	4066
1763267999675	love	1370	100	0:0:0:0:0:0:0:1	OK	3921

7. Deployment on GitHub Codespaces

My entire web service runs live on GitHub Codespaces.

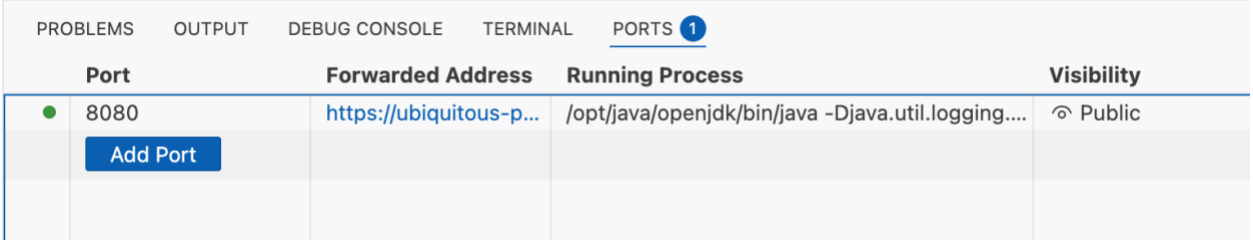
Deployment steps:

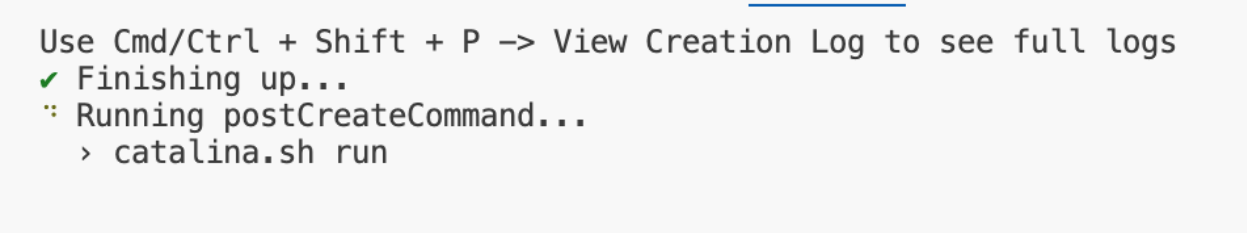
1. Use Codespaces with a Tomcat-enabled Dockerfile
2. Tomcat 9 starts automatically
3. Port **8080** is forwarded publicly
4. URL appears as:

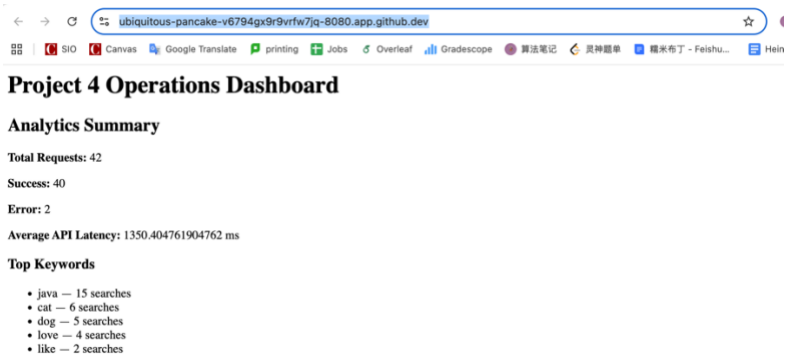
```
https://ubiquitous-pancake-v6794gx9r9vrfw7jq-8080.app.github.dev/
```

5. Android app uses this URL for live requests

Reminder: If codespace does not build automatically, please click rebuild the project, then it will work.







Conclusion

✓ Native Android App
✓ Java Servlet Web Service
✓ Third-Party API Integration
✓ Logging (6+ fields)
✓ MongoDB Storage
✓ Web Dashboard with Analytics
✓ Deployment on GitHub Codespaces

The system includes a working end-to-end distributed application involving:

Android → Servlet → Third-Party API → MongoDB → JSP Dashboard

All components are functional, deployed, and tested.
