The Process and User Interface to Streamline Cleanroom Communication and Assembly Status

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GitHub

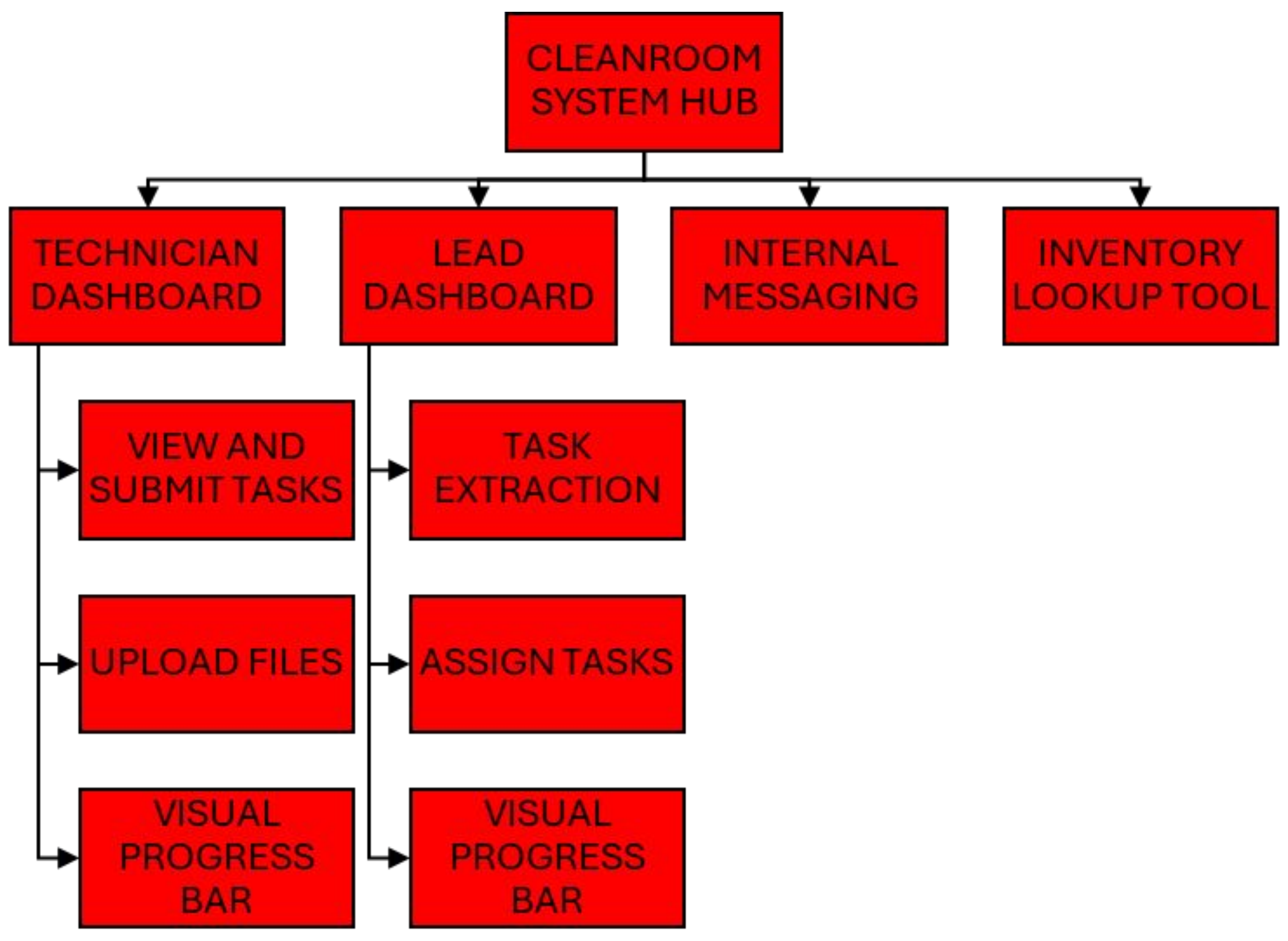
SLAC NATIONAL ACCELERATOR LABORATORY | U.S. DEPARTMENT OF ENERGY | Stanford University | LCLS Linac Coherent Light Source

BACKGROUND

Cleanroom environments demand precise task tracking, documentation, and coordination. However, current processes rely on scattered tools, often resulting in delays, errors, and miscommunication. A unified digital system is essential to improve efficiency, accountability, and real-time visibility.

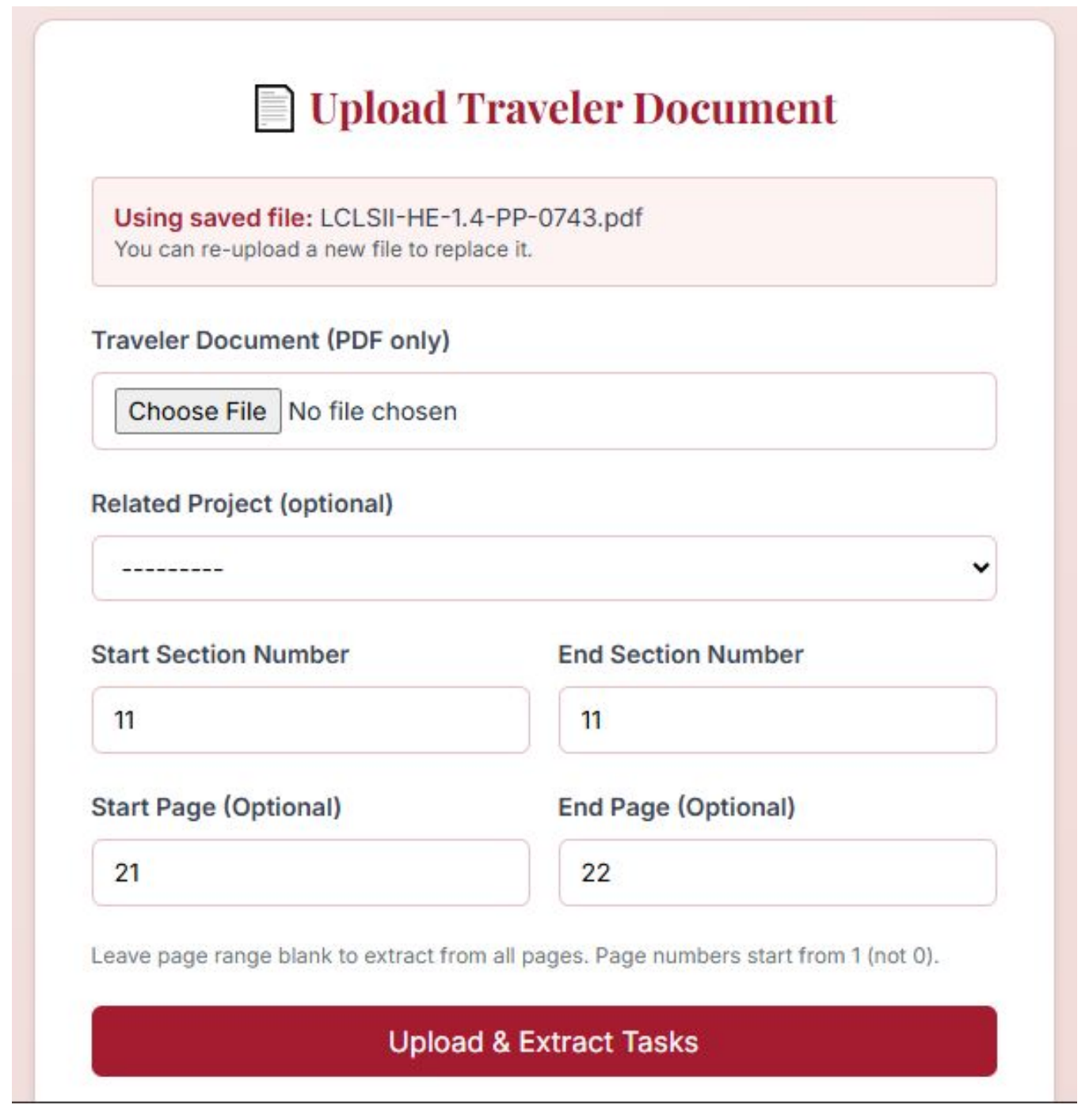
APPROACH

- Conducted user interviews with technicians and leads to guide system design
- Extracted tasks from pdf and word docs using *pymupdf* and *python-docx*
- Built role-based dashboards, approval flows, and messaging with *django*
- Styled responsive ui components using *tailwind css*
- Parsed excel files with *pandas* for assembly parts and inventory lookup
- Added visual progress bars to track task and project completion in real time



System Flowchart

USER INTERFACE



📄 Upload Traveler Document

Using saved file: LCLSII-HE-1.4-PP-0743.pdf
You can re-upload a new file to replace it.

Traveler Document (PDF only)
Choose File No file chosen

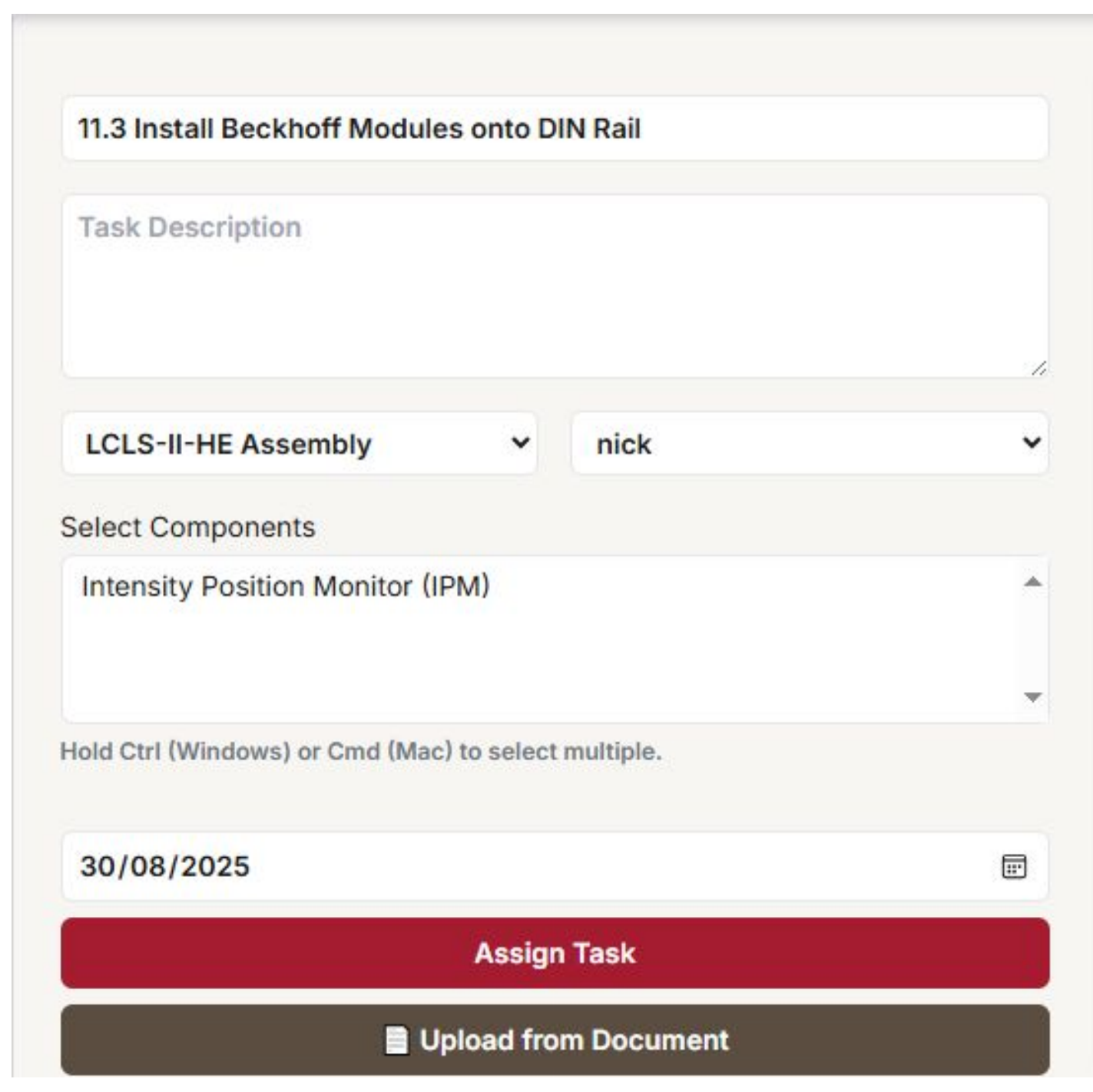
Related Project (optional)

Start Section Number: 11
End Section Number: 11

Start Page (Optional): 21
End Page (Optional): 22

Leave page range blank to extract from all pages. Page numbers start from 1 (not 0).

Automatic Task Extraction



11.3 Install Beckhoff Modules onto DIN Rail

Task Description

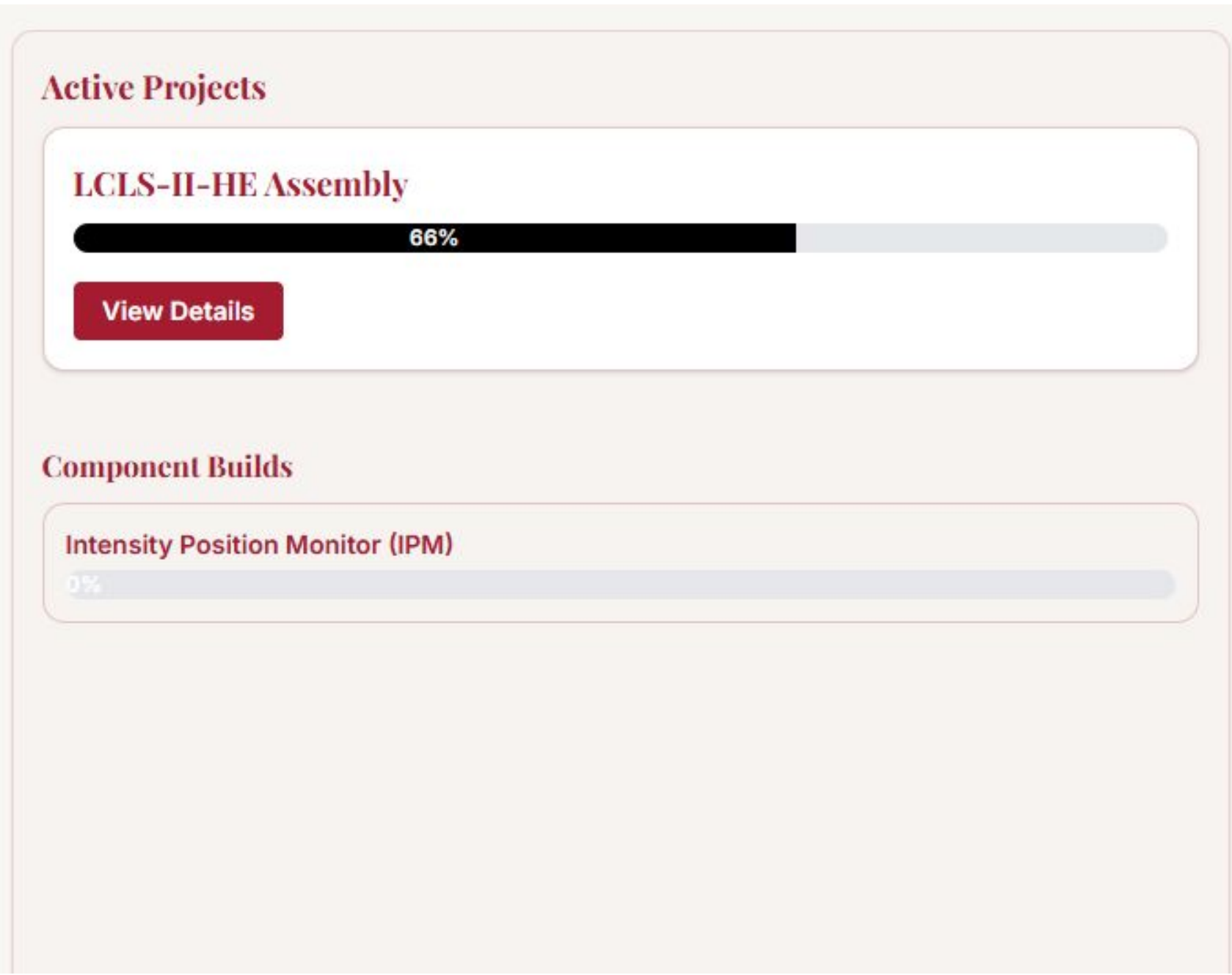
LCLS-II-HE Assembly
nick

Select Components
Intensity Position Monitor (IPM)

Hold Ctrl (Windows) or Cmd (Mac) to select multiple.

30/08/2025

Task Assignment



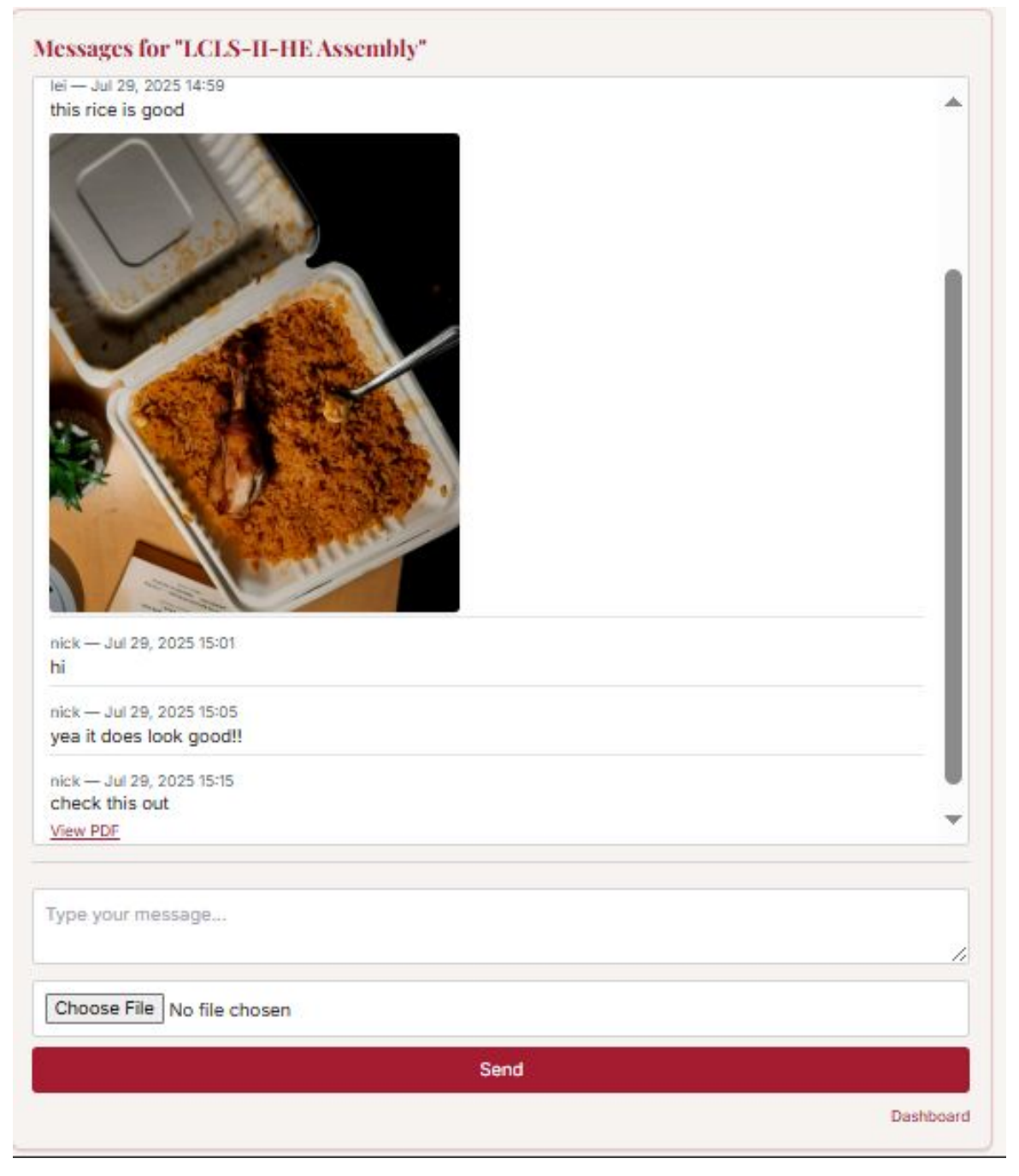
Active Projects

LCLS-II-HE Assembly
66%

Component Builds

Intensity Position Monitor (IPM)
0%

Auto-Update Progress Bars



Messages for "LCLS-II-HE Assembly"

lei — Jul 29, 2025 14:59
this rice is good

nick — Jul 29, 2025 15:01
hi

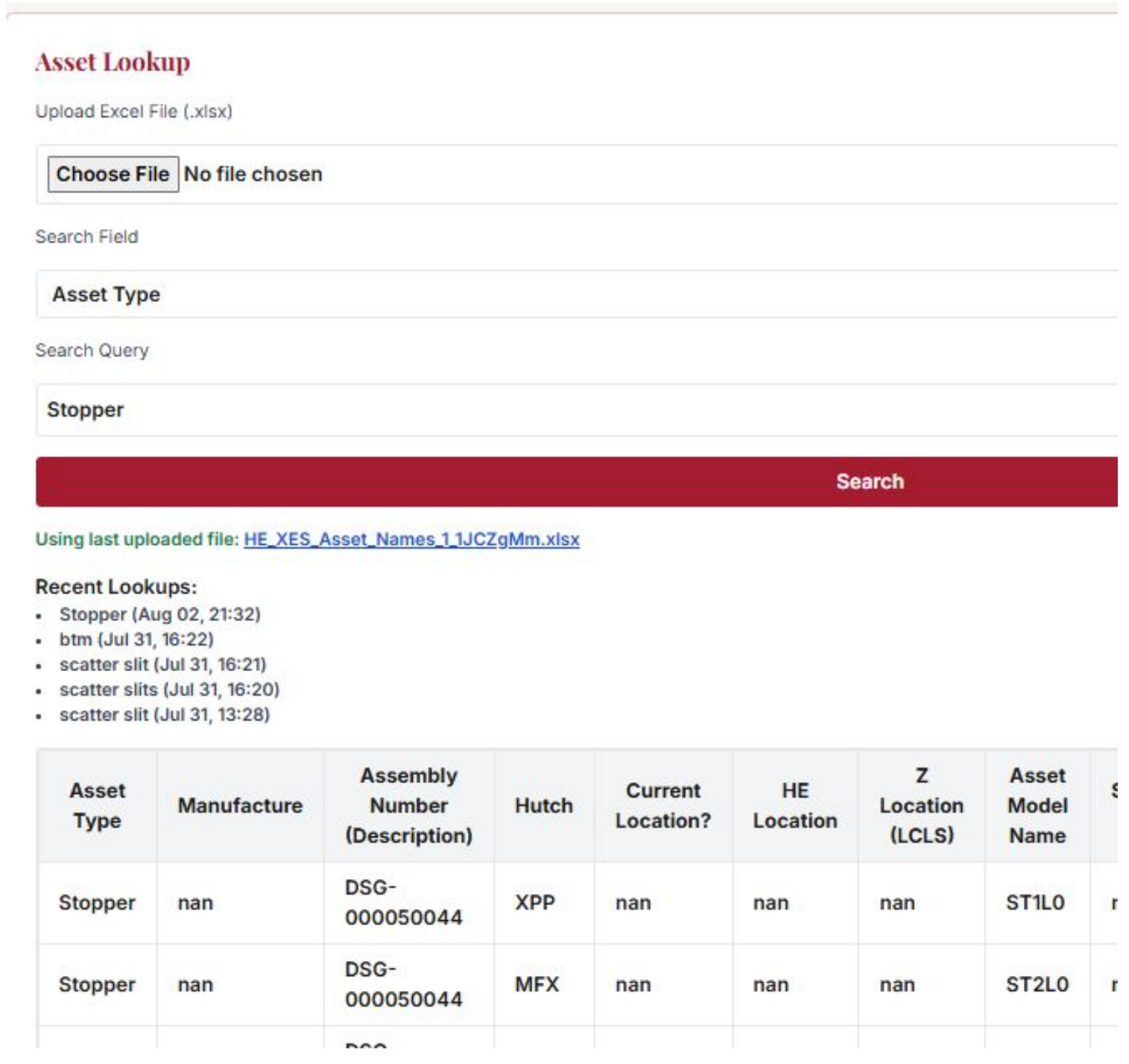
nick — Jul 29, 2025 15:05
yea it does look good!!

nick — Jul 29, 2025 15:15
check this out
View PDF

Type your message...

Choose File No file chosen

Internal Messaging Panel



Asset Lookup

Upload Excel File (.xlsx)
Choose File No file chosen

Search Field
Asset Type

Search Query
Stopper

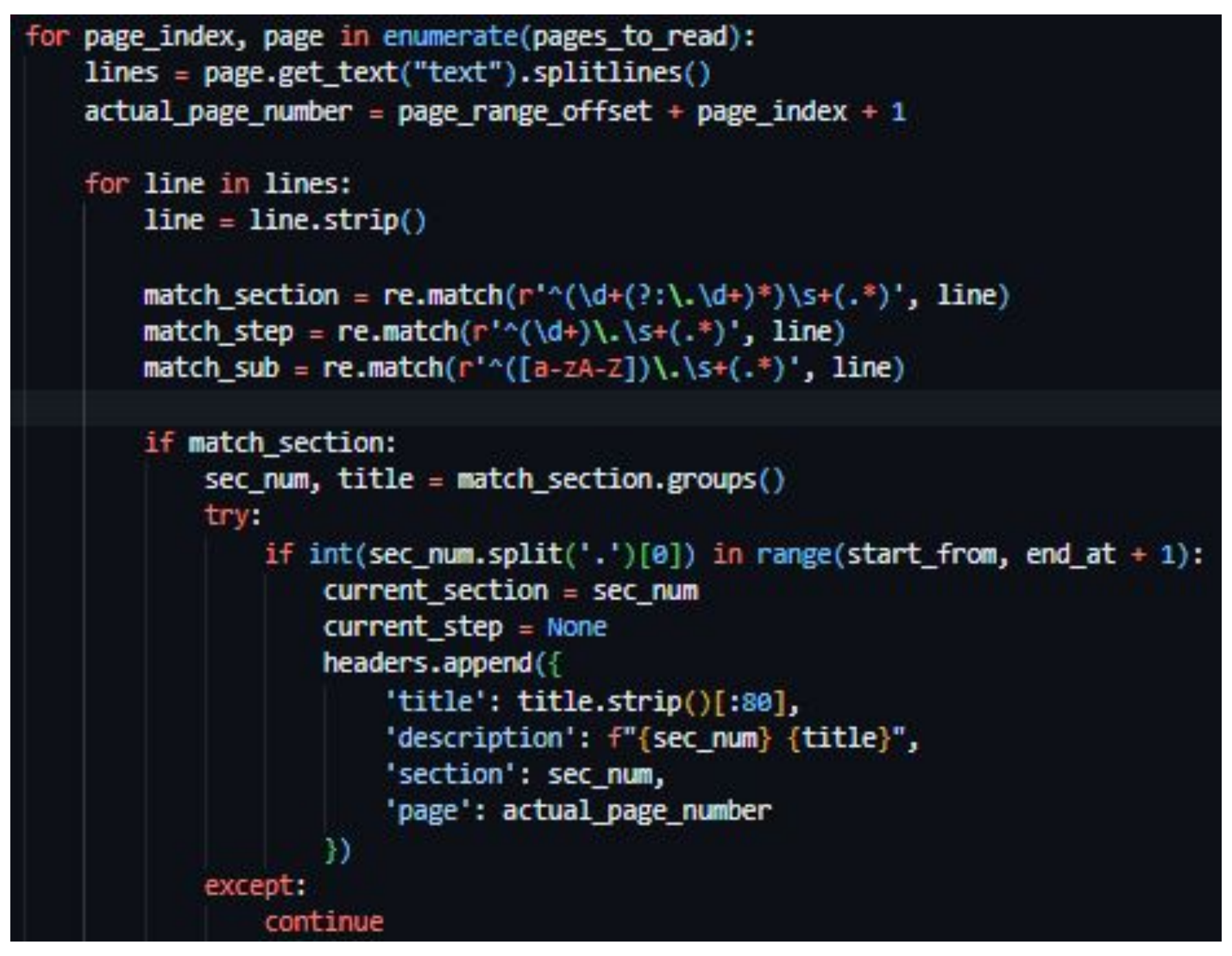
Using last uploaded file: HE_XES_Asset_Names_1_1JCZgMm.xlsx

Recent Lookups:
- Stopper (Aug 02, 21:32)
- btm (Jul 31, 16:22)
- scatter slit (Jul 31, 16:21)
- scatter slits (Jul 31, 16:20)
- scatter slit (Jul 31, 13:28)

Asset Type	Manufacture	Assembly Number (Description)	Hutch	Current Location?	HE Location	Z Location (LCLS)	Asset Model Name
Stopper	nan	DSG-000050044	XPP	nan	nan	nan	ST1L0
Stopper	nan	DSG-000050044	MFX	nan	nan	nan	ST2L0

Inventory Lookup Result

CODE SNIPPET



```python
for page_index, page in enumerate(pages_to_read):
    lines = page.get_text("text").splitlines()
    actual_page_number = page_range_offset + page_index + 1

    for line in lines:
        line = line.strip()

        match_section = re.match(r'^(\d+(?:\.\d+)*)\s+(.*)', line)
        match_step = re.match(r'^(\d+)\.\s+(.*)', line)
        match_sub = re.match(r'^([a-zA-Z])\.\s+(.*)', line)

        if match_section:
            sec_num, title = match_section.groups()
            try:
                if int(sec_num.split('.')[0]) in range(start_from, end_at + 1):
                    current_section = sec_num
                    current_step = None
                    headers.append({
                        'title': title.strip()[:80],
                        'description': f"{sec_num} {title}",
                        'section': sec_num,
                        'page': actual_page_number
                    })
            except:
                continue
```

Task Extraction Logic

Category	Before (Manual)	After (System)
Task assignment	Manul and time-consuming	Automated from documents
Task tracking	Spreadsheet-based	Real-time dashboard with progress bars
Inventory look-up	Manual Excel search	Integrated search tool
Communication	Verbal or Email	In-app messaging

FUTURE WORK

- Integrate an AI assistant to answer user queries from traveler documents and inventory files
- Generate automated reports (PDF/CSV) for project leads or lab audits
- Explore gesture navigation (touchless) for environments where gloves limit touch screens

ACKNOWLEDGEMENTS

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REFERENCES

[1] LCLS-II-HE PF2L2 Wavefront Sensor Assembly Traveler. Document No. LCLSII-HE-1.4-PP-0743-R1. SLAC National Accelerator Laboratory. Rev. R1, Released December 17, 2024.

[2] Dauzon, Samuel, Aidas Bendoraitis, and Arun Ravindran. *Django: web development with Python*. Packt Publishing Ltd, 2016.