Major Presentation

DSL 810

Project Brief

- A printer sized device (or a little bigger) capable of storing physical documents for quick retrieval at will.
- While inserting pages, the user is asked to name the document and organise them in folders (just like electronic documents are stored in PCs).
- The user can then browse through the files or perform a name search to retrieve the document as and when required

Features of the Device

- Multiple pages document
- A4, letter and legal sized pages
- On board touchscreen display
- Schedule a scan of the stored documents.
- Max time of retrieval : 30s
- An additional space (box) to store small notes or bills

Building the Prototype

- We have four major mechanisms:
  - Embedded systems: controlling microcontrollers, motors, display
  - Scanning Mechanism : scanner, rollers and separator lifter
  - Retrieval Mechanism : rollers along with clamper and separator lifter
  - Counting Mechanism : counts using suction motor

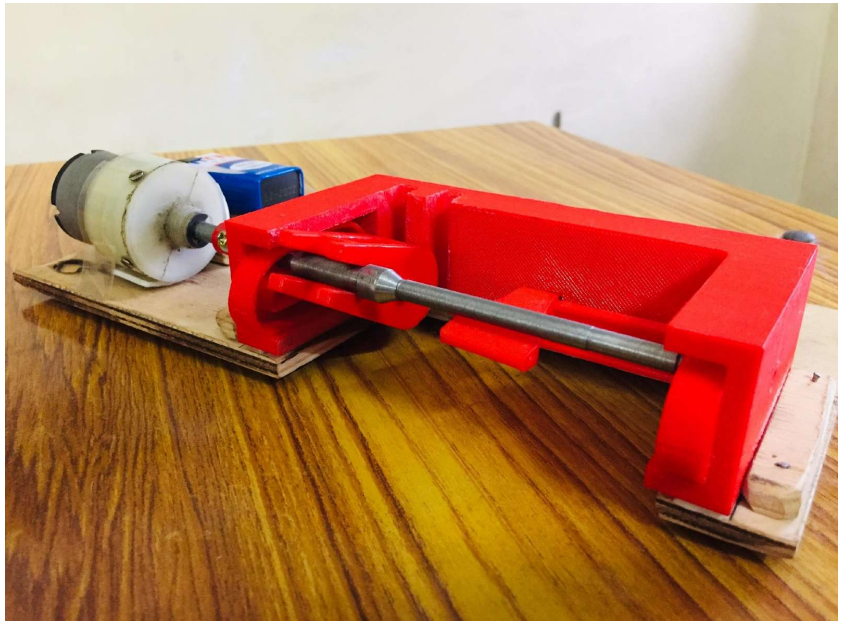


Figure: Counting mechanism (already developed)

For the purpose of DSL810 the deliverables were associated with EMBEDDED SECTION

Embedded Tasks

- UI
  - Onboard Display
  - App
- Digital Sorting : DBMS
  - Security Profiles
  - Algo
  - Data Structure
- WiFi Module Integration
- TouchScreen LED Integration
- Control
  - Microprocessor
  - DC - DC Convertors
- Scanner Integration
- Power Supply

- Activity Diagrams & FSMs for States
  - Insertion
  - Retrieval
  - Scanning
  - Idle
    - Truly idle
    - Physical Sorting/ Troubleshooting
- Controlling the individual components
  - Clamper Clamp
  - Clamper Wheels
  - Counter
    - Suction Fan Motor
    - Pin Motor
    - Leadscrew Motor
    - Cam (for engagement/ disengagement of counter)
  - Retrieval mechanism
    - Actuator for physical separation - 2
    - Actuator for lifting
    - Ejector

Benchmarking different Components

- Wifi Module
  - Frequency Band : 2.4GHz/5GHz (both are available usually)
  - Range: 10 meters (Onboard Pi)
- Microcontroller
  - Raspberry Pi 3 Model B V1.2
- Suction Motor (for counting mechanism)
  - 12V brushless dc suction motor (2A current), IFD04048B12C
- Scanner Module
  - CIS scan head
  - Hp/Canon

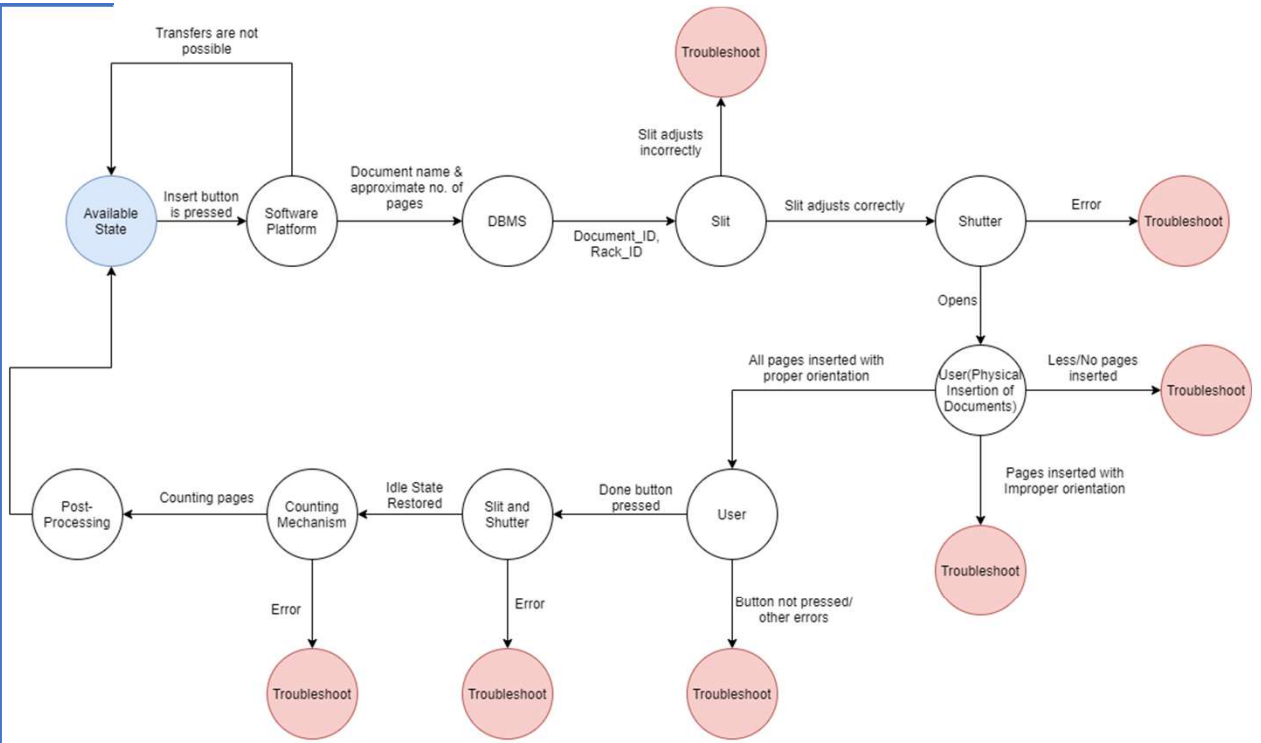
Benchmarking different Components

- Display
  - 7 inch LCD display (TFT LCD Display)
- Driving motors
  - 5/12V DC motors (depending on the operation)

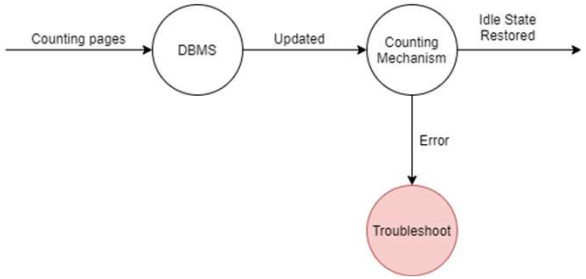
Activity Diagrams

- The activity diagrams are drawn to map the states of the machine at various time frames
- We draw the activity maps for the mechanisms as well as for the individual components

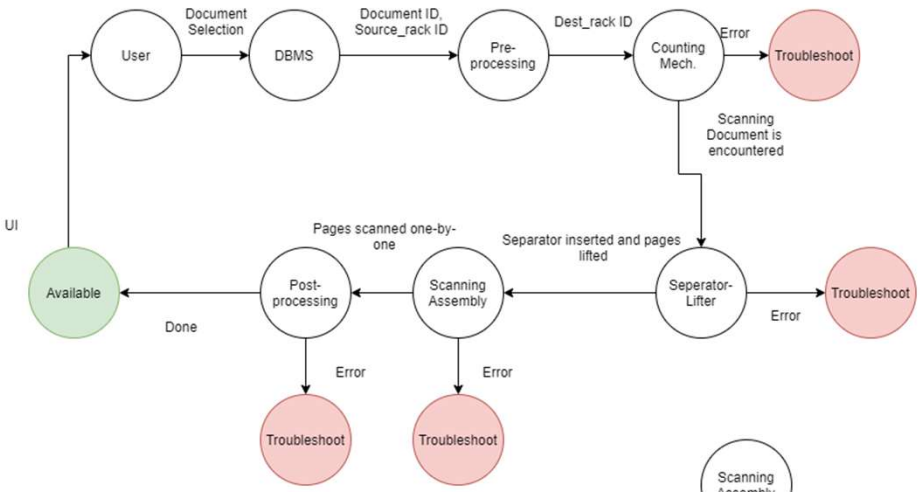
Insertion Mechanism

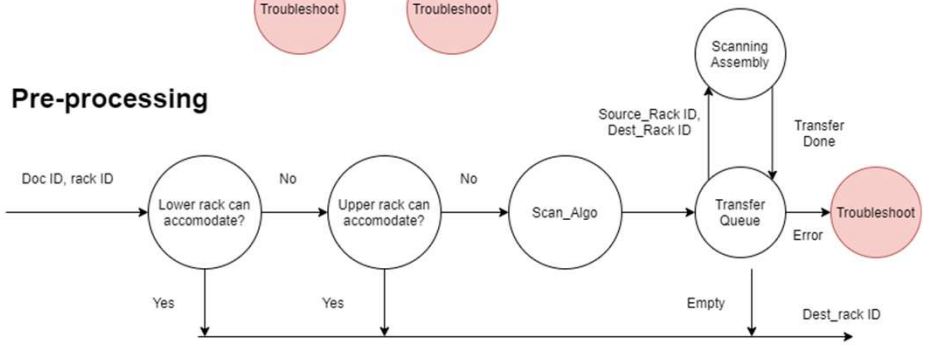


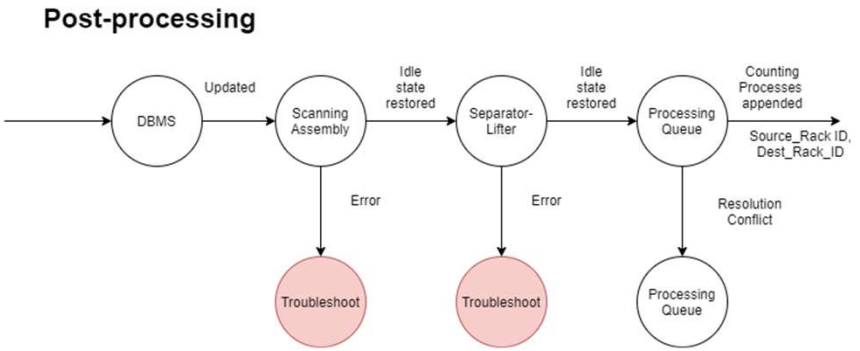
Post Processing



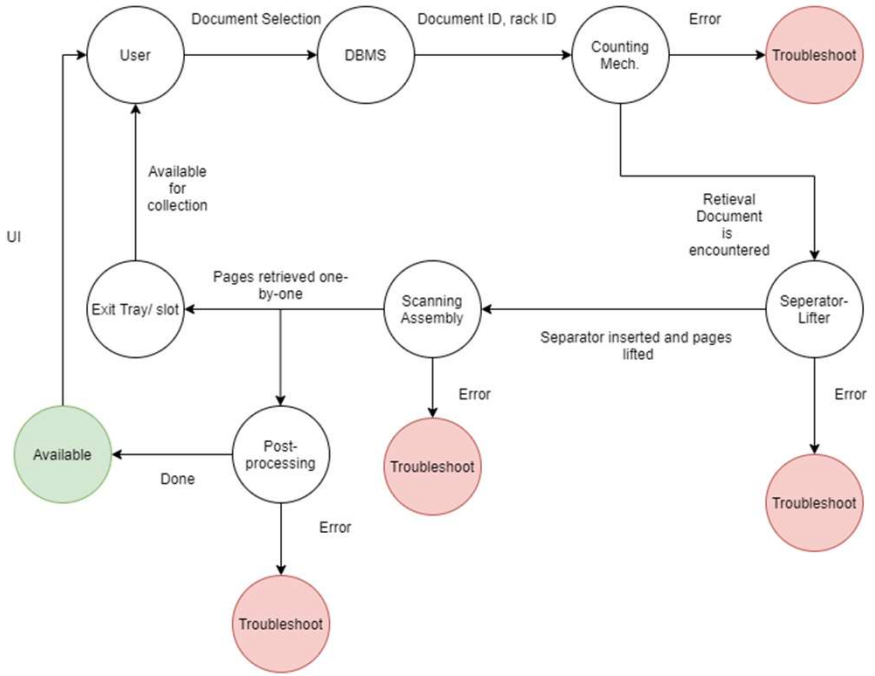
Scanning Mechanism

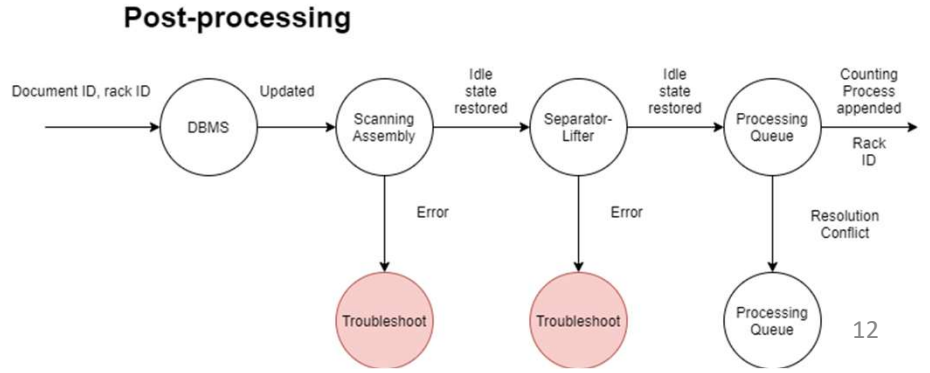




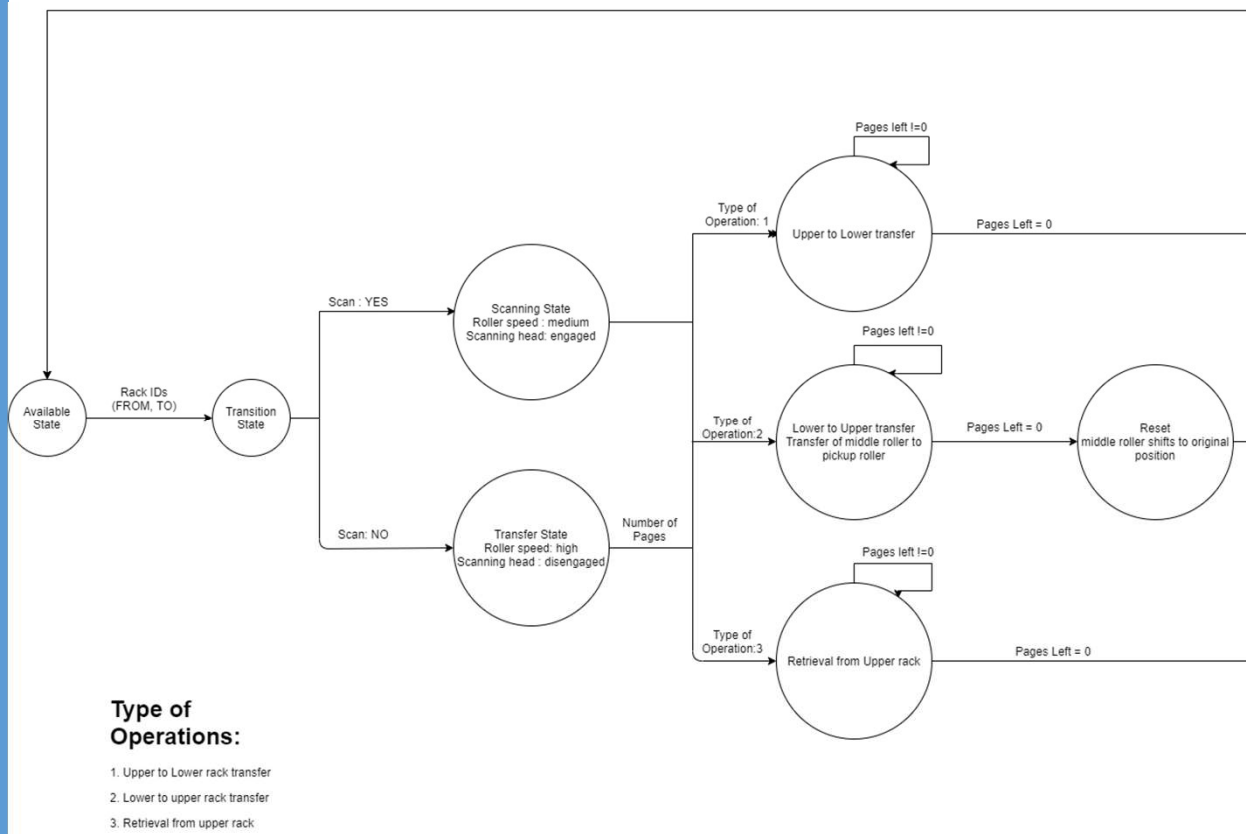


Retrieval Mechanism





Scanning Assembly



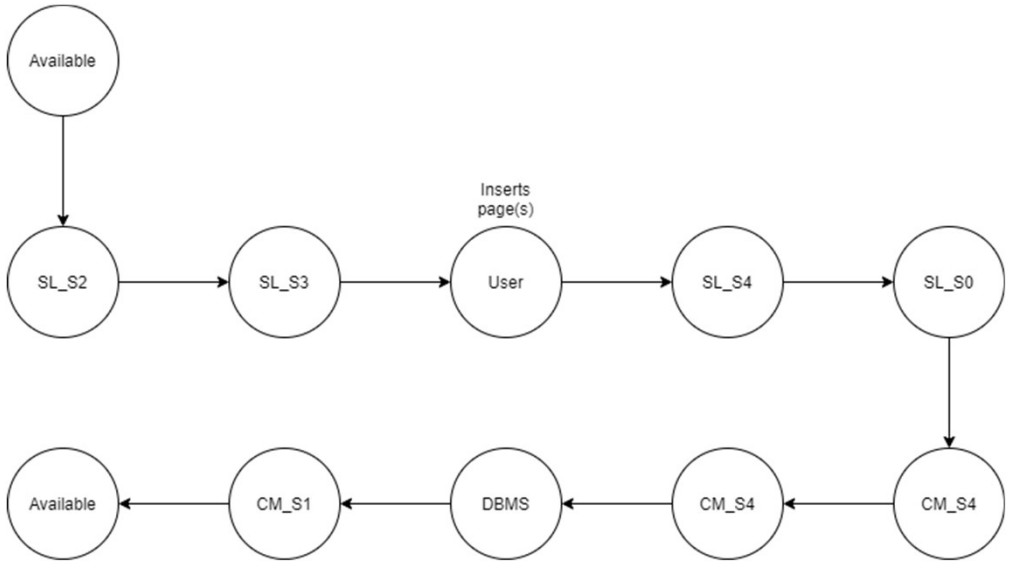
Type of Operations:

1. Upper to Lower rack transfer
2. Lower to upper rack transfer
3. Retrieval from upper rack

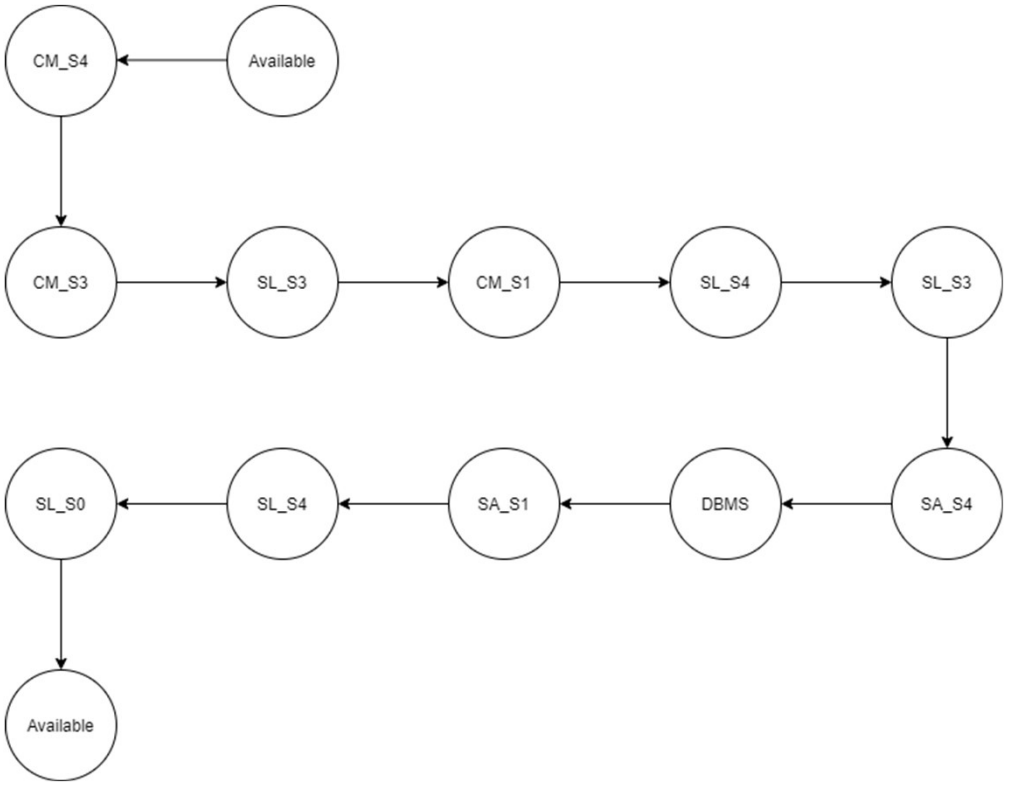
Finite State Machines

- FSM are made for each of the mechanism for microcontroller coding
- In FSM diagrams we have specified the changes in the states for the mechanism as well as for the individual components

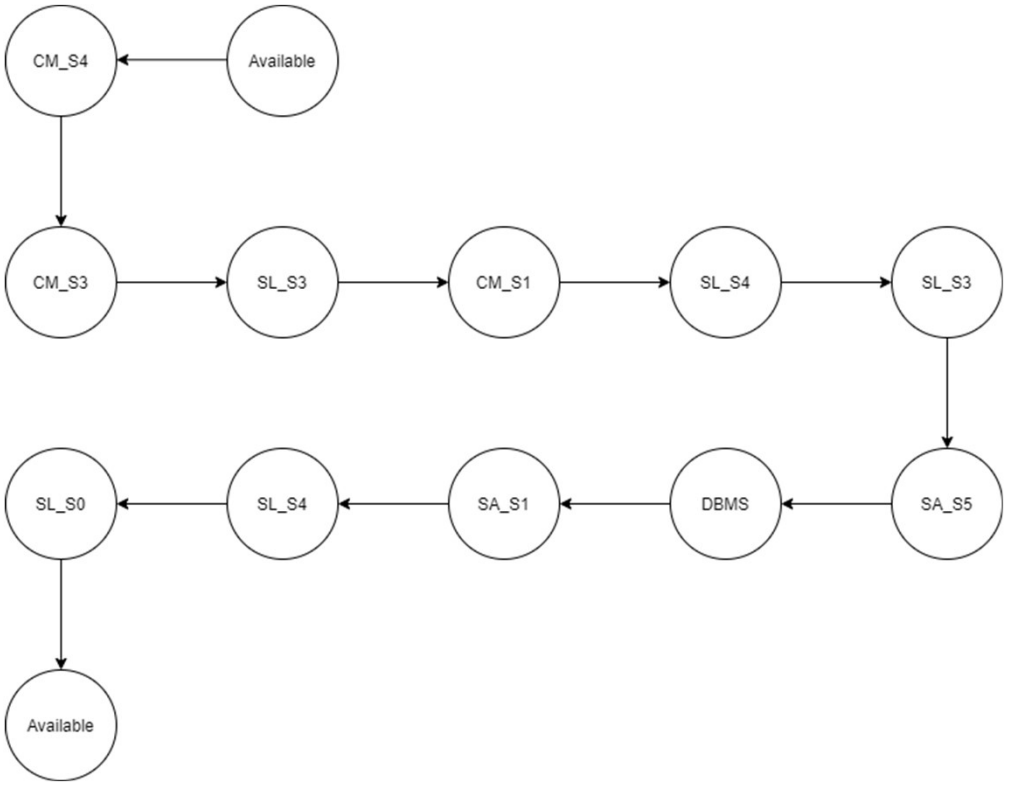
Insertion Process



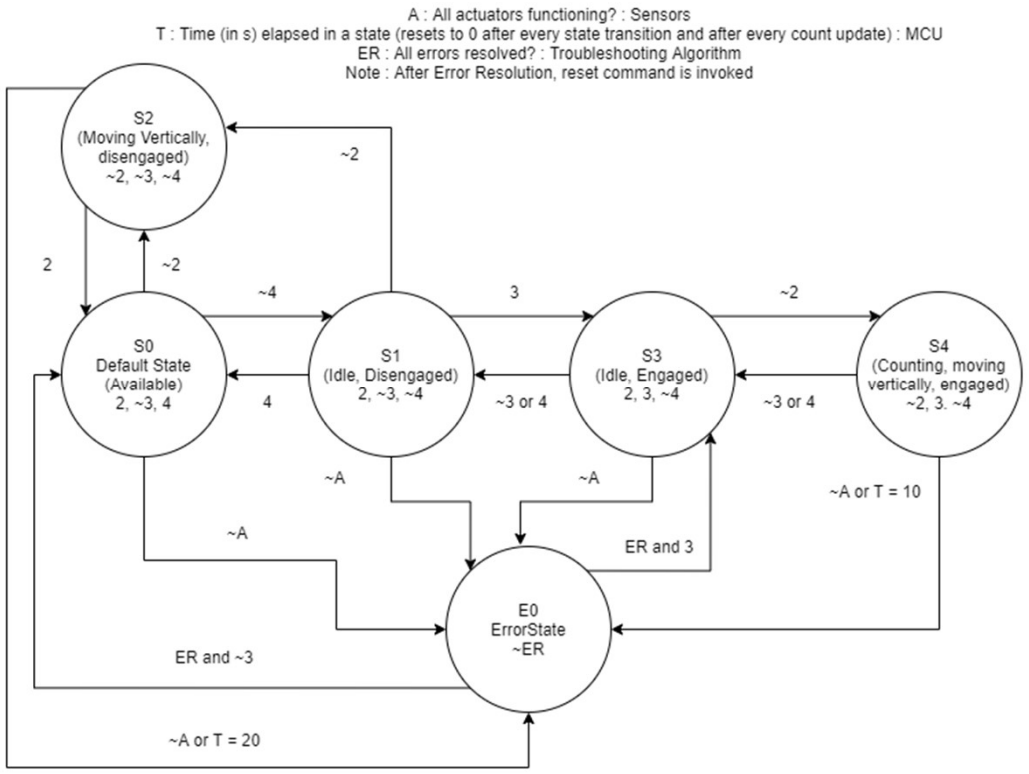
Retrieval Process



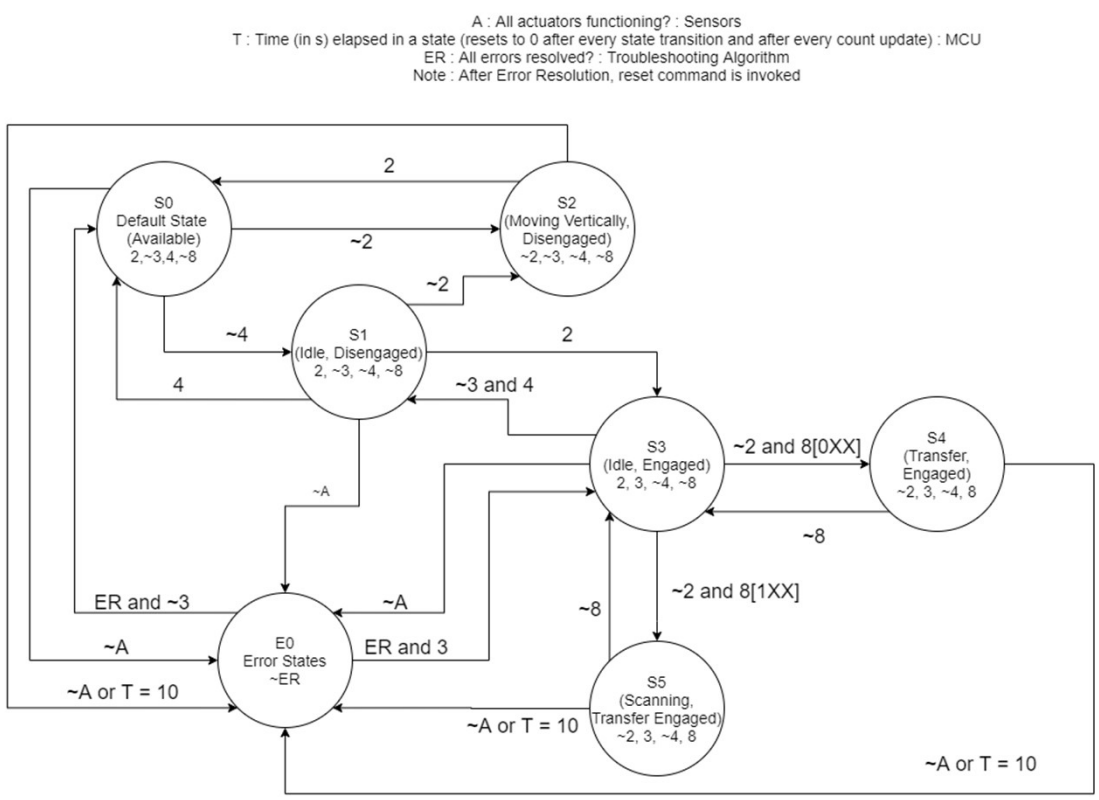
Scanning Process



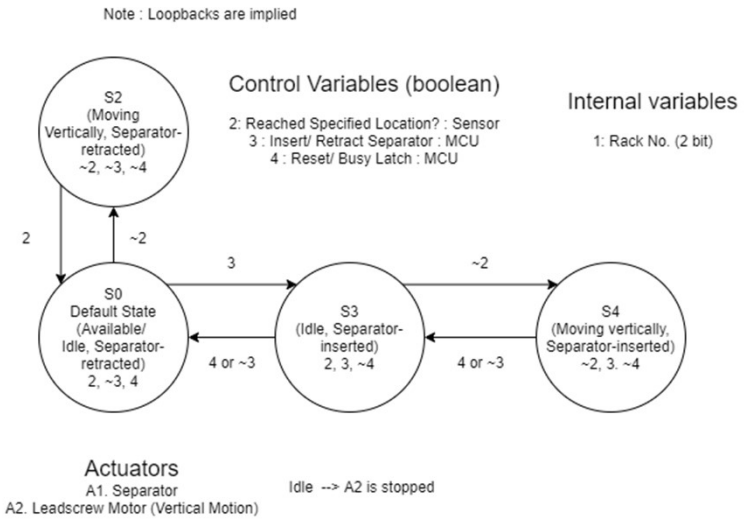
Counting Mechanism

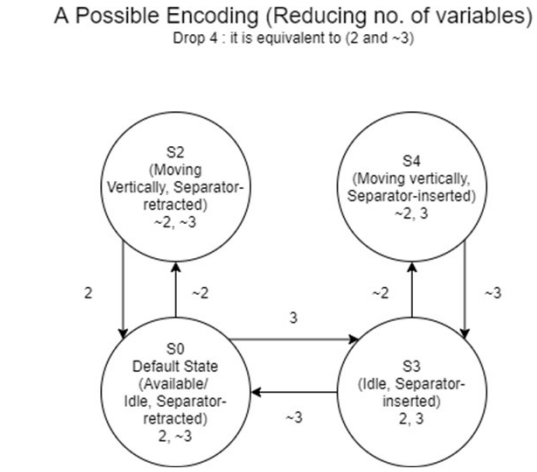


Scanning Assembly



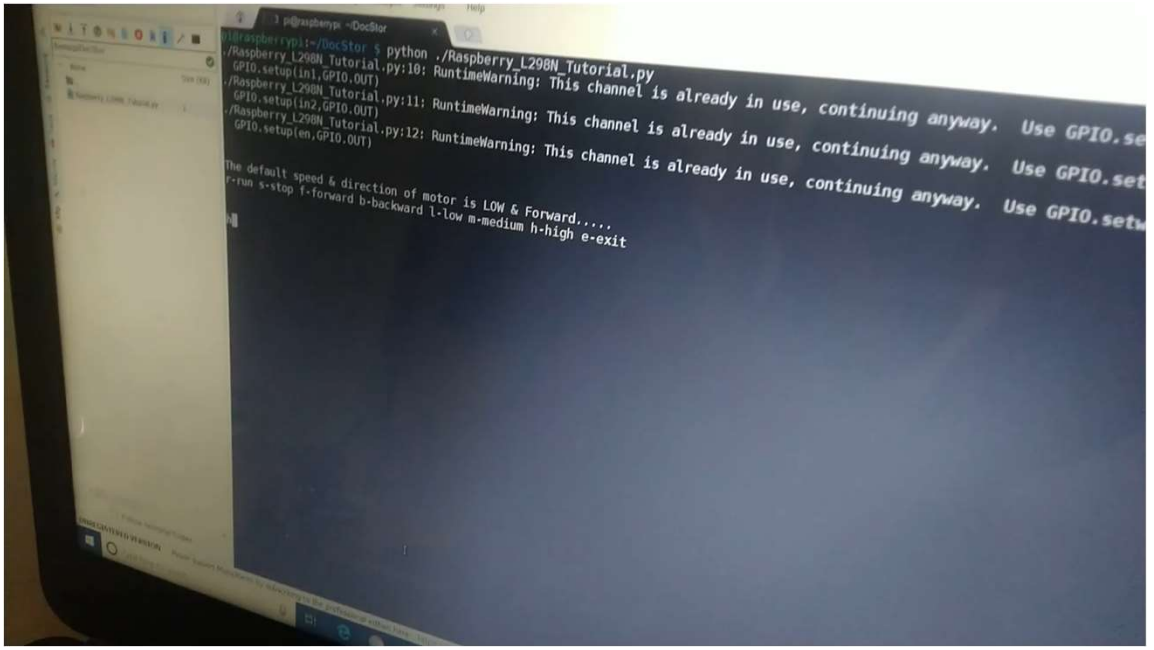
Separator Lifter





Controlling Suction motor using PWM

- Microcontroller used: Rpi
- Code is available here
- Video available here



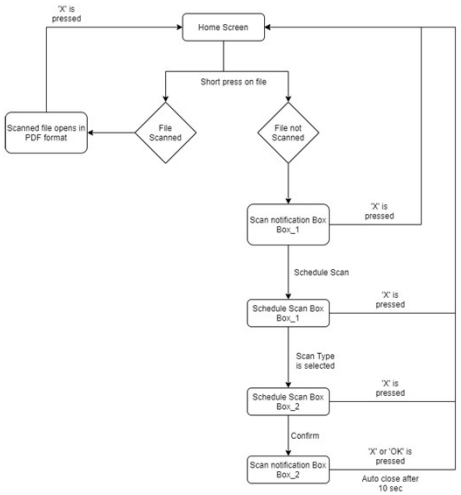
Scanner Integration with RPi

- Tried with two scanners:
  - HP scanjet 200
  - HP deskjet 1050
- Problems:
  - HPLIP was available only for Linux (we were using Raspbian)
  - A package was available from SANE for deskjet 1050, but since deskjet 1050 is a printer and scanner integrated module, not possible to have only scanner functioning due to internal security checks of the board
- While dismantling HP deskjet 1050, we came across interesting mechanism of working of printer (video available on right or click here)
- Meanwhile, **Lockdown Happened**

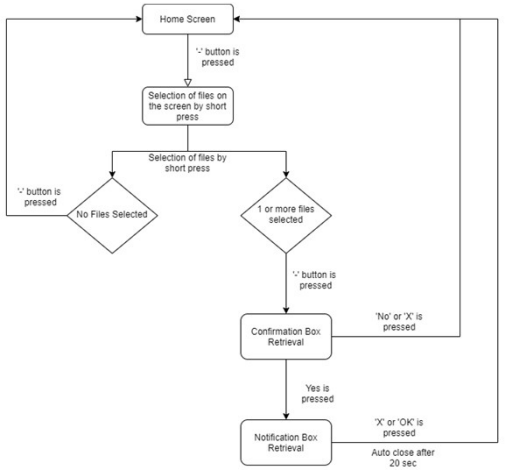
UI Design

- Initial proposed the flow diagrams for different screens
- Creation of screen layouts
- Platform for building the UI: Kivy (comparison available here)

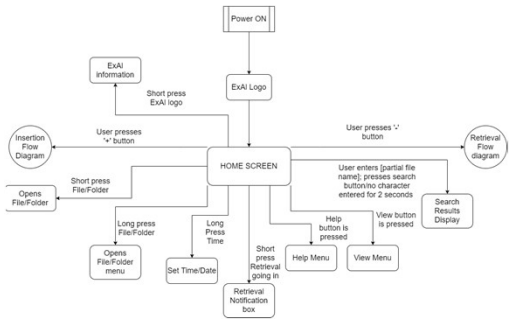
UI Flow Diagrams



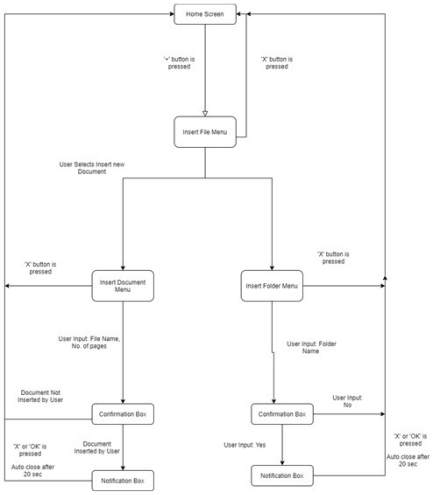
Retrieval flow diagram



Scanning flow diagram



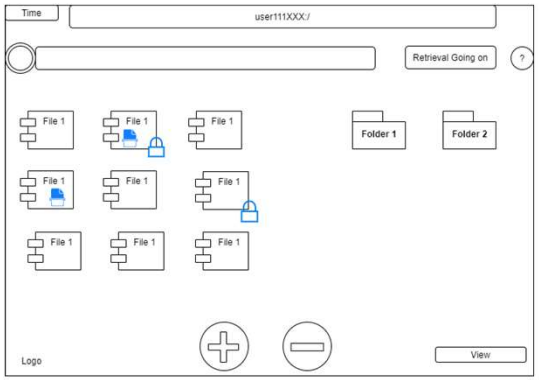
General flow diagram



Insertion flow diagram

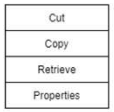
UI Screens

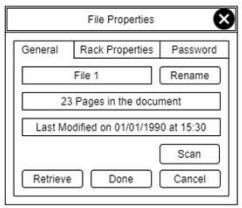
- Glimpse of Some UI screens is given on the Right
- All the screens are available here

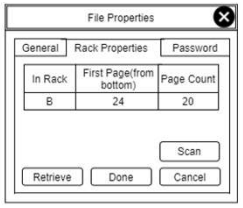


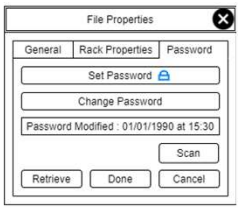
Thumbnail View

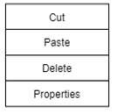
Detail View

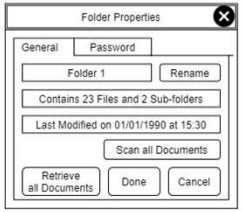


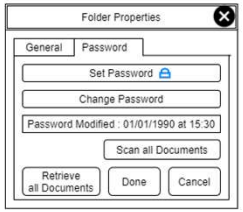


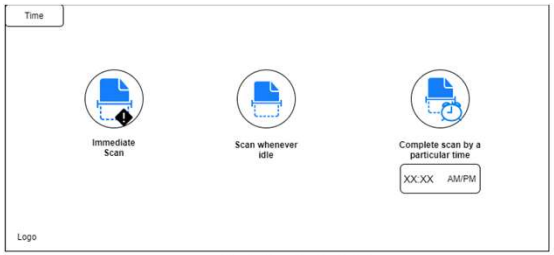












Box_1 : No option is selected

Box_2: Option is selected

Progress Till now

- Counting Mechanism completed
- Backend Coding has been completed(in C++)
- Scanning assembly, retrieval mechanism, separator lifter design and CAD modelling completed
- Embedded Systems design are completed

Future Goals

- Manufacturing of the Prototype once the institute reopens
- Henceforth Integration of the Embedded components
- Completion of First Prototype
- Improvements in the Capacity and Insertion/Retrieval time
- Integration of disinfection of the paper while storage

Thank You