TFIP DA CET1011 Practicum 1

Short Paragraph Solution

There are two main components: the access card and the smart door lock. Each access card is updated daily via RFID/NFC with generated booking codes that reflect the user's room, date, and time in the format RM##DDMMYYHH. Door locks independently generate, refresh and store their own codes hourly based on the same format and checks for matches when a card is scanned. If a valid code matches what is found on the staff's ID card, the door unlocks. Else, it remains locked.

Detailed Solution

Booking System
- An online booking system would allow labstaff to make bookings of the rooms remotely
- When a booking is made, a code will be generated based on the booking's time, date and room number. (I.e RM#DDMMYYHH) where
  - RM## - Room ##
  - DDMMYYHH - Date & Time In 24H format
- Bookings are stored in a database linked to each staff's ID.

Access Cards
- Each lab staff member is issued an access card with a unique staff's ID.
- Based on the staff's ID, their current valid booking codes are written to the card.
- Cards are updated daily using RFID/NFC via a mobile device or card terminal.

Locks
- Each lock generates a unique unlock code based on the same format: RM#DDMMYYHH matching the lock's room number and current date and hour.
- This unique code is refreshed every hour and only valid during the hour, which represents the valid access code for that specific time slot.
- When a labstaff scans their card against the lock, the lock would check if the ID card contains the matching code during the hour.
- When the card code matches the door's code, the door would allow access. Otherwise, it would remain locked.

Pseudocode

Code writing into access cards:

1. Start Card Writing
2. Check current date, delete historical bookings
3. For each Staff_ID:
        Retrieve today's bookings for Staff_ID
4. For each booking:
        Generate Booking_Code using same format
5. Write all Booking_Codes to the staff's access card
6. End Card Writing

Door lock access check:

1. Start Door Lock
2. Lock Get Time Date
3. Generate Unlock_Code based on Time, Room Number (for each lock)
   Code Format: RM#DDMMYYHH
4. When scanned with card, Get Booking_Code
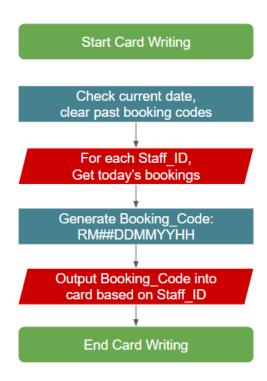5. If Unlock_Code = Booking_Code then
        Unlock door
6. Else
        Do not unlock door
7. Stop Door Lock

Flowchart

Card writing flowchart:

```
┌─────────────────────────────┐
│      Start Card Writing      │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     Check current date,      │
│   clear past booking codes   │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│      For each Staff_ID,      │
│     Get today's bookings     │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│     Generate Booking_Code:   │
│         RM##DDMMYYHH         │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│    Output Booking_Code into  │
│     card based on Staff_ID   │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│       End Card Writing       │
└─────────────────────────────┘
```

Door lock flowchart:

```
┌─────────────────────────────┐
│       Start Door Lock        │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│   Generate Access_Code Hourly:│
│         RM##DDMMYYHH         │
└─────────────────────────────┘
              │
              ▼
┌─────────────────────────────┐
│    Get Booking_Code from     │
│         Card Scan            │
└─────────────────────────────┘
              │
              ▼
        ◇ Booking_Code =      ── Yes ──▶ ┌──────────────┐
          Access_Code ◇                   │  Unlock lock  │
              │                           └──────────────┘
              │ No                               │
              ▼                                  │
┌─────────────────────────────┐                 │
│       Keep lock closed       │                 │
└─────────────────────────────┘                 │
              │                                  │
              ▼                                  │
┌─────────────────────────────┐ ◀───────────────┘
│        End Door Lock         │
└─────────────────────────────┘
```