SOFTWARE ENGINEERING CS 487
Homework-2

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1) Design a lecture enhancement system (LES) which:
   – Keeps a student effectively engaged throughout by:
   • filtering out extraneous noise,
   • maintaining a comfortable temperature, and
   • prompting the student whenever their awareness drops
   – Partners effectively with sensors and other systems

   For Developing an ideal learning environment through the integration of many technologies is necessary when designing a lecture enhancement system (LES) tomaintain students' effective engagement throughout.

   While designing and developing the LES system its important to Consider the following concepts of
   System Modeling
   Architectural Design
   Design and implementation and most importantly
   Dependability and Reliability
   - Repairability
   - Maintainability
   - Survivability
   - Error tolerance
   - Security Management
   - Dependable Programming
   - Design for Security

- Systems and sensors To enhance the effectiveness of the Lecture Enhancement System (LES), it can effectively partner with various sensors and systems.

- **System for Controlling Temperature:**

    - Install **smart HVAC (heating, ventilation, and air conditioning) systems** that makes sure that the classroom is always at a suitable temperature.

Utilise **occupancy sensors** to modify the temperature in the classroom according to the **number of students attending it.**

- **System for Filtering Noise:**

    - To reduce background noise from outside the classroom, turn on the **noise-cancelling equipment** that is built into the sound system.
      To lessen echo and internal noise, use **acoustic panels** or other **sound-absorbing materials** in the classroom.

- **System for Tracking and Prompting Awareness**:

    - Use gadgets with **biometric sensors** or a **computer vision system** to track students eye movements, facial expressions, and **physiological indicators** like heart rate variability to determine how attentive they are.
    - Utilise **AI algorithms** to evaluate the information and find indications of declining interest.
    - Encourage students to participate in interactive tests, answer thought-provoking questions, or provide visual signals when they lose focus by using the classroom display or personal devices.

- **Integration and Control**
    - A **central command system** that combines information from the systems that measure **consciousness, regulate temperature, and filter noise**.
    - This hub uses **artificial intelligence algorithms** to plan the classroom based on predetermined criteria and real-time data.

- **User Interface:**
    - Students and instructors could have access to a user interface, such as a mobile app or web portal, to provide feedback on the classroom environment and engagement levels.

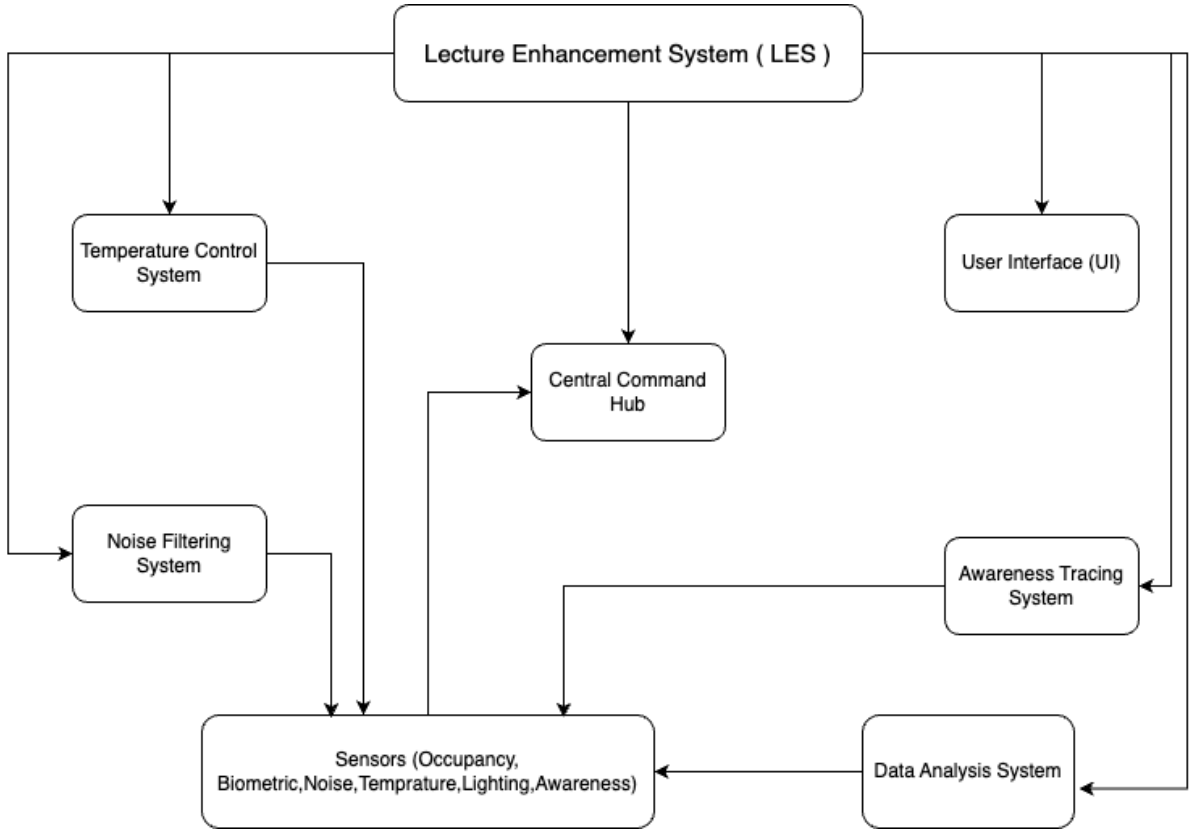
- **Flexible Lighting:**
    - In order to maintain the ideal learning environment, incorporate advanced lighting solutions that may adjust colour temperature and brightness.

- **Data Analysis:**
    - For the purposes of post-lecture analysis and LES enhancement, the system needs to gather information on classroom circumstances and student involvement levels.
- **Occupancy Sensors**:
    - To find out how many students are in the classroom, collaborate using occupancy sensors. Based on the actual occupancy, the temperature and ventilation settings may be changed using this data.
- **Biometric Measurements:**
    - In order to assess students' levels of involvement, integrate portable biometric sensors or computer vision systems to track physiological indicators like heart rate variability, face expressions, and eye movements.
- **Noise Level Sensors:**
    - Collaborate with noise level sensors to measure the ambient noise within the classroom. This data can be used to adjust the noise cancellation system and maintain a suitable learning environment.

Advantages of Integrating Sensors and Systems:

- Real-Time Adaptation: Based on the data gathered, the LES may dynamically alter the classroom environment in real-time by collaborating with sensors and systems.
- Integrated Learning Environment: By integrating several technologies, an ideal learning environment may be created that takes comfort, engagement, and sensory stimulation into account.
- Effective Resource Management: Utilising energy and ventilation resources wisely in accordance with real-world classroom settings is made possible by collaborating with smart technologies and sensors.

2. Draw a context model showing the system and its partners



3. Specify a binary protocol for all C-C-I communication

We must describe the **message structure** that is sent between **various components** in order to provide a **binary protocol** for c**omputer-to-computer interaction** in the Lecture Enhancement System (LES) scenario.

Header of Message:

Components of the message header include the following:

Start of Message : A single byte marker (0xAA) designating the message's start.

Message Length: The overall message length is represented by 2 bytes (16-bit unsigned integer).

Message Type: A single bit field used to list the various kinds of messages.One byte has been set up for future usage.

Message Payload: Depending on the kind of communication, variable length

Message Footer: 1 byte at the end of the message (0x55)

Error Situation:

Binary Number: 000 Description: Signals a systemic issue or malfunction.Payload: Optional; may contain an error code or error information.

Case with High Temperature: Binary Code: **001**

This indicates that the temperature in the classroom is high.Temperature information (16-bit signed integer expressing temperature in Celsius) is the payload.

Low-Temperature Situation: 010 in binary code

Description: Shows that the classroom is not too warm.Temperature information (16-bit signed integer expressing temperature in Celsius) is the payload.

Case with High Noise Level: 010 in binary code

This indicates that there is a lot of noise in the classroom.Data about noise level (an 8-bit unsigned integer) is the payload.

Command Case for Control: 101 in binary code

This description denotes a control command that subsystems have received from the Integration and Control Hub.Payload: Data (varying length depending on the command) and control command (enumeration expressing various control commands).

Case Feedback: 110 in binary code

Description: Shows comments made by people via the user interface, such as students or teachers.Payload: Feedback data (varying length) and user ID (32-bit unsigned integer).

Analysis Outcome Example: 111 in binary code

Description: Shows the outcome of the Data Analysis System's data analysis.Payload: Variable-length analysis result.

4. Specify a LES-to-student protocol (C-H-I)

LES-to-Student Protocol: This protocol **enables communicatio**n between the **human users** (students) of the **Lecture Enhancement System** (LES) in order to improve the quality of their educational experience.

- **Awareness Prompot** :
  - The LES keeps track of how engaged the students are throughout lectures.
  - The LES notifies the student's device or smartphone when their awareness falls below a certain threshold.
  - The prompt to return attention to the lecture material may include visual indicators, such a message on the student's screen or a little vibration.

- **User-Interface interaction:**
  - Students can engage with the system by using the LES to provide them access to a user interface on their devices.
  - Via the interface, students may see real-time statistics on the state of the classroom, student participation, and offer comments.

- **Engaging in Interactive Learning:**
  - Students can participate in interactive learning activities including polls, debates, and quizzes with the help of the LES.

- Students can use their gadgets to actively engage in class activities or they can interact with the LES interface.

- **Personalised Notifications:**
  - Students receive customised notifications from the LES according to their learning needs and preferences.
  - Notifications concerning important course materials, individualised study advice, or reminders for impending tasks are some examples of alerts.

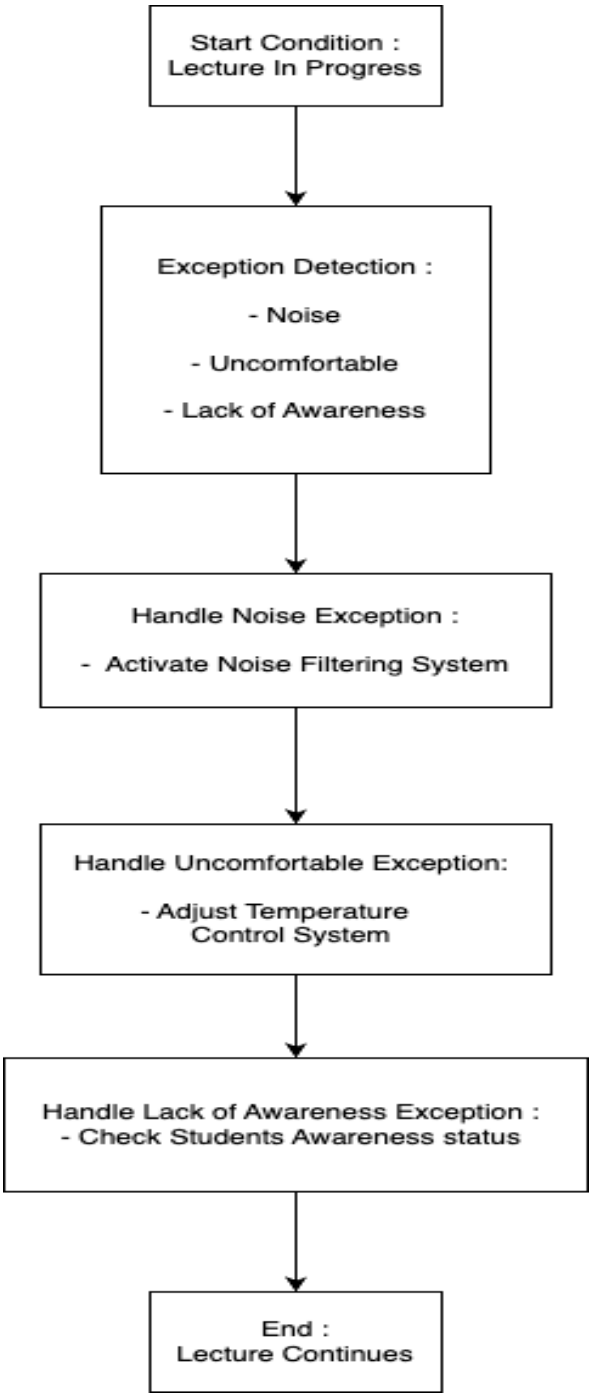
- **Access to Resources:**
  - Through the LES interface, students may access lecture notes, course materials, and additional resources.
  - Easy access to instructional materials is made possible by the LES to complement student learning goals.

- **Integrating Wearable Technology:**
  - When students choose to utilise wearable technology, such fitness trackers or smartwatches, accessibility and convenience are increased since they can get feedback and awareness reminders right on the device.
  - Summary of Post-Lecture Engagement:
  - Students receive a summary of their participation and engagement levels following the lecture, along with suggestions for development or more reading.

- **Adaptive Academic Resources:**
  - Learning materials are dynamically adjusted by the LES to meet the requirements and preferences of individual students.
  - Method: To adjust the pace, complexity, and delivery of information, adaptive algorithms examine data on student performance and engagement.

- Interaction: Personalised information and activities that are in line with their learning objectives are provided to students who engage with adaptive learning materials via digital platforms or interactive displays.

5. Use flowcharts to explain the detection and handling of “noise”, “uncomfortable”, and “lack of awareness”, exceptions



Start: The lecture is in progress.

Exceptions are always being detected by the system, which keeps an eye out for things like noise, unpleasant surroundings, and students not paying attention.

Handle Noise Exception: To minimise background noise and provide a comfortable learning environment, the system turns on the noise filtering mechanism when it detects noise.

Handle Uncomfortable Exception: The system modifies the temperature management system to guarantee a comfortable atmosphere for students if it detects uncomfortable situations (such as a temperature that is too high or low).

Handle Lack of Awareness Exception: When the system detects that a student is not paying attention to the lecture material, it provides awareness cues (such as alerts and mild vibrations) to help them focus again.

End: To ensure the best possible learning environment, the lecture continues with the exceptions addressed.