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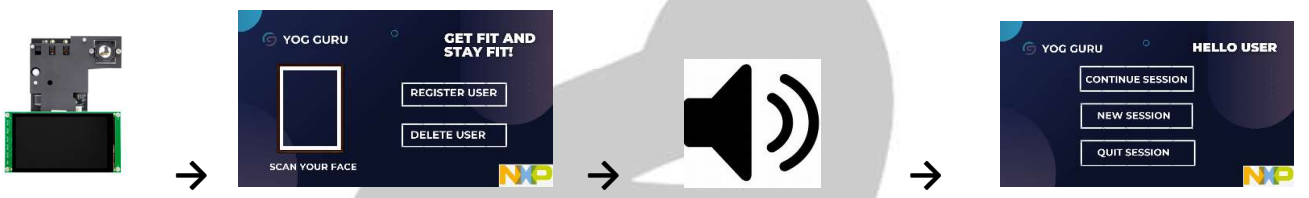
- **Title of the Project:** YOG GURU (AI-Integrated Smart Yoga Device for Personalized Yoga Experience)
- **Hardware Platform Selected:** NXP Edge Ready Smart HMI Solution Based on i.MX RT117H with ML Vision, Voice, and Graphical UI
- **Abstract:** The YOG GURU project aims **to transform the traditional practice** of yoga by integrating **advanced AI technologies** into a Smart Yoga Device. This innovative Device will offer **real-time posture correction, track user progress**, and provide personalized yoga content **curated by experts**. By leveraging **machine learning (ML) and computer vision**, the Smart Yoga Device enhances the yoga experience, making it **more interactive, accessible, and tailored to individual needs**, thereby fostering physical fitness, mental well-being, and stress reduction
- **Technology used**

- **Overview:**

  The YOG GURU project introduces a Smart Yoga Device equipped with camera sensors and AI capabilities to analyze and improve users' yoga postures. The Device is integrated with the NXP Edge Ready Smart HMI Solution based on the i.MX **RT117H platform, which supports ML Vision**, **Voice recognition, and a Graphical User Interface (GUI)** to deliver a comprehensive and immersive experience.



Nxp Hardware → GUI that will be created by GUI guider → assistant guides through app → Registered user identified via face recog

List of pose available in the menu → User guide with proper steps and pose analyzer

Implementation Details

1. Project Initialization

- Set up Development Environment: Begin by setting up the necessary development tools, including ***MCUXpresso IDE***, ***GUI Guider***, *and* ***LVGL***.
- Install SDKs: Download and install the required SDKs, such as the ***RT1170 SDK*** *and* ***SLN-TLHMI-IOT software*** from NXP's GitHub repository.

2. GUI Development with LVGL

- **Design GUI Using GUI Guider**:
  - Create separate screens for various states like **Standby**, **Session**, and **Feedback**.
  - Add interactive elements such as **widgets**, **buttons**, and other UI components for user interaction.
- **Integrate GUI with Voice and Pose Data**:
  - Link recognized voice commands (e.g., "**Hello Yog Guru**") to trigger corresponding actions in the GUI.
  - Display real-time pose feedback on the GUI based on the camera's analysis of the user's posture.

3. Hardware Setup

- Prepare Hardware:
  - Set up the ***SLN-TLHMI-IOT kit*** using the ***i.MX RT117H MCU*** as the central processing unit.
- Checking Peripherals:
  - Checking the Attach peripherals like the ***camera*** for posture detection and ***microphones*** for voice input and commands.

4. Voice Recognition Implementation

- Integrate DSMT Model Libraries:
  - Add ***DSMT (Deep Speech Model for Text)*** libraries to the project to handle voice recognition.
  - Configure the ***Audio Front-End (AFE)*** for processing microphone inputs.
- **Set Up Voice Wakeup Commands**:
  - Define wake-up phrases like **"*Hello Yog Guru*"** and support multiple languages.
  - Use the DSMT model to recognize these wake words and commands for starting yoga sessions or requesting feedback.
- **Update HAL Drivers**:
  - Include drivers for the microphone and update the HAL for ***DSMT and AFE*** to manage voice data.
  - Ensure recognized commands are processed and transmitted to the GUI for appropriate actions.

5. Pose Detection Implementation

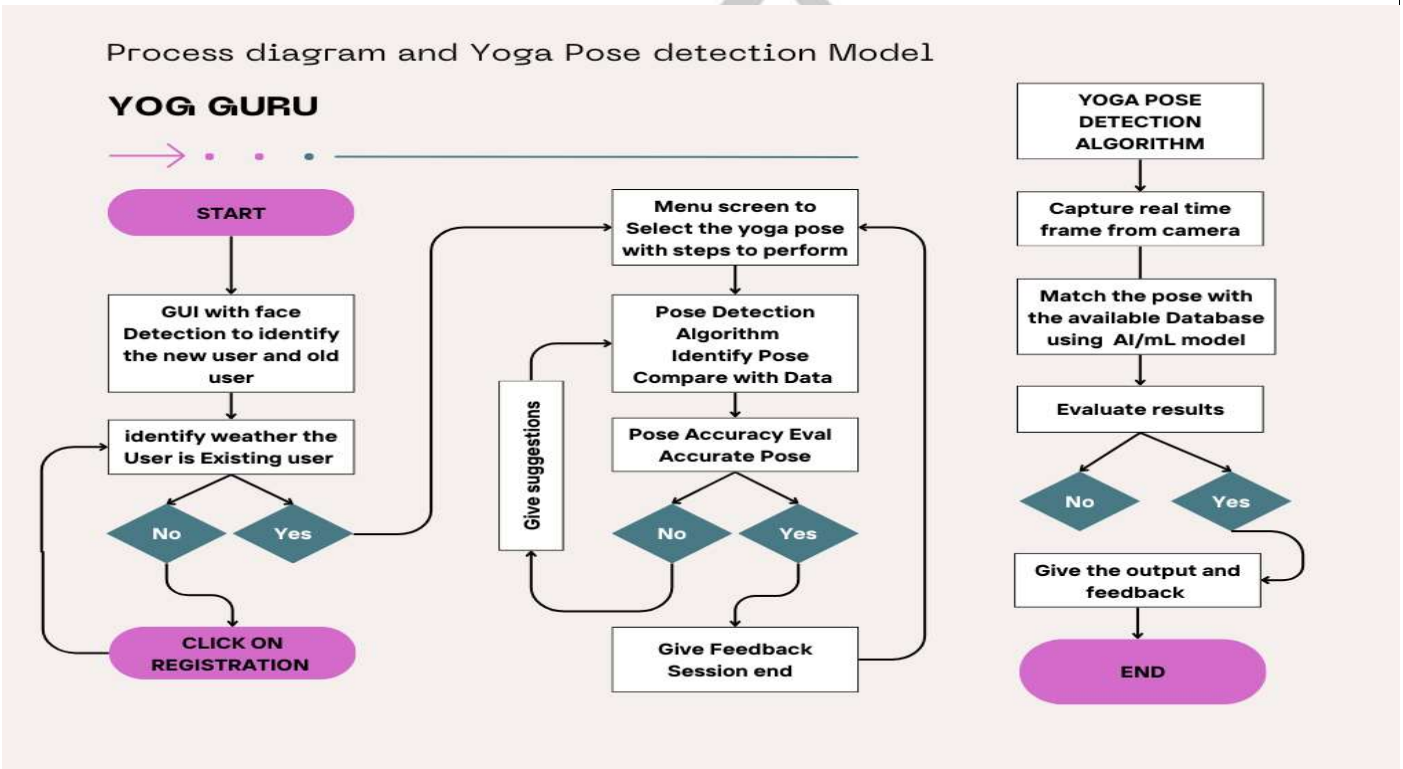
- Posture Recognition Workflow:
  - Recognition Button: When the user presses the "Recognition" button, capture a frame (or multiple frames) from the camera showing the user in a yoga posture.
  - Posture Detection: Implement a posture detection algorithm (such as ***PoseNet*** *or* ***OpenPose***) to identify the key joints (shoulders, knees, elbows) in the captured frames.
  - **Feature Matching**: Compare the detected posture's key points and angles with previously stored postures in the ***database*** to assess how closely the user matches the correct pose.

- **Posture Feedback**: Provide real-time feedback, such as **"*raise your arms higher*"** or **"*align your back*"**, to help the user adjust their posture and provide the progress after successful completion of the yoga session

6. Testing and Debugging

- **Simulate GUI Interactions**:
  - Use **GUI Guider** to test the GUI's response to simulated voice commands and pose detection without deploying to hardware.
- **Deploy on Hardware**:
  - Transfer the project to the actual hardware setup and test the functionality of both voice and posture recognition in real-time

Block Diagram:



Example of its Application: Imagine a user practicing yoga at home using the YOG GURU Device. As they perform various poses, the mat's sensors detect their movements and postures. The AI system analyzes this data in real-time, identifying any deviations from the correct posture. The user is immediately notified of these errors through visual cues on the screen and voice prompts, allowing them to adjust their pose for optimal performance.

- In a professional setting, such as a yoga studio, instructors can use the YOG GURU Device to monitor multiple students simultaneously. The system provides personalized feedback for each student, enabling the instructor to focus on guiding the class while ensuring everyone maintains proper form. This application demonstrates the mat's potential to enhance yoga practices, whether at home or in a group environment.

Benefits and Value Addition: Improved Accuracy: The mat helps users perform yoga poses more accurately, reducing the risk of injury and enhancing the effectiveness of their practice.

(1) Personalized Experience: The mat provides tailored content and real-time feedback, making yoga accessible to individuals of all skill levels.

- **Market Differentiation**: YOG GURU's unique value proposition lies in its ability to combine traditional yoga with cutting-edge technology, setting it apart from other fitness products in the market.

References:

- https://docs.nxp.com/bundle/AN14263/page/topics/legal_information.html
- https://docs.nxp.com/bundle/AN14015/page/topics/overview.html
- https://github.com/pkafma-aon/mcu-smhmi

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