Implementation details of DRS Modules

1. Mobile UI (Camera Module) + Integration of all Modules

- **Description**: Captures live video feed of the cricket pitch through the mobile application's interface and sends the video frames for further processing.
- **Output**: Video frames in real-time.
- **Next Module**: Sends frames to the **Ball and Object Tracking Module**.

---

2. Ball and Object Tracking Module

- **Description**: Detects and tracks critical objects including the ball, stumps, batsman, and bat. Calculates the ball's 3D coordinates (x,y,z) over time, along with stump and batsman positions.
- **Output**:
    - Ball trajectory as (x,y,z) coordinates.
    - Batsman's leg position and orientation.
    - Stump position.
    - Bat position.
- **Next Module**: Outputs data to the **Bat's Edge Detection Module**.

---

3. Bat's Edge Detection Module

- **Description**: Analyzes the ball and bat data to detect if the ball has contacted the bat edge.
- **Output**:
    - If bat edge is detected: Updates ball trajectory based on bat contact.
    - If bat edge is not detected: Confirms no contact and proceeds to next step.
- **Next Module**:
    - If no bat edge is detected and ball hits the batsman's leg: Passes data to **Trajectory Analysis Module**.

---

4. Trajectory Analysis Module

- **Description**: Calculates the ball's future path using its current trajectory and determines whether it would hit the stumps. Integrates factors like spin, bounce, and drag for accuracy.
- **Output**:
    - Predicted trajectory.
    - Decision on whether the ball will hit the stumps.
- **Next Module**: Sends the trajectory and decision data to the **Stream Analysis and Overlay Module**.

---

5. Stream Analysis and Overlay Module

- **Description**: Enhances the video stream with visual overlays, including ball trajectory, decision markers, and other graphical elements for display to the umpire or viewers.

- **Output**: Augmented video stream with trajectory and decision visualizations.

Overall Data Flow

1. **Mobile UI (Camera Module)** → Captures video and sends frames to **Ball and Object Tracking Module**.

2. **Ball and Object Tracking Module** → Tracks ball, bat, batsman, and stumps; sends x,y,z ball coordinates, batsman, and stump positions to **Bat's Edge Detection Module**.

3. **Bat's Edge Detection Module** → Detects bat contact:

    - If bat edge detected: Modifies ball trajectory.

    - If no edge: Checks for ball-leg contact and sends data to **Trajectory Analysis Module**.

4. **Trajectory Analysis Module** → Predicts ball's future path and sends trajectory and decision to **Stream Analysis and Overlay Module**.

5. **Stream Analysis and Overlay Module** → Produces augmented video stream with overlays for final visualization.

Architecture Diagram