**PROJECT OVERVIEW: PRIMARY OBJECTIVES:**

* To develop a robust pipeline to collect accurate rPPG signals using cameras
* Must be robust to accommodate with varying specifications and ensure reliable heart rate calculation.
* Developing a single pipeline control system.
* Standardizing the video collection process.
* Extracting rPPG signals
* Accurately calculating heart rates from these signals.

**KEY TASKS AND DELIVERABLES**

**Task 1: Develop Preprocessing Submodule of Pipeline Control System**

* **Objective:** Design and implement a system to manage variations in frames per second (FPS), bitrate, and stream dimensions.
* **Process:** 
  + Research state-of-the-art methods for handling video stream variations including changes in lighting conditions.
  + Analyze FPS, bitrate and stream dimensions for 2MP to 6MP cameras.
  + Replicate state-of-the-art methods for handling video stream variations.
  + Create a target design specification for the pipeline control system. **[Target FPS, bitrate and stream dimension]**
  + Implement preprocessing submodule for standardizing video parameters to predefined target specification in previous step.
  + Implement preprocessing submodule for adjusting to changes in light conditions.
* **Return Deliverables:**
  + Detailed target design specification **[Target FPS, bitrate and stream dimension].**
  + Documentation (detailed write-up) on preprocessing submodule of pipeline control system.
  + Executable and script of preprocessing submodule.

**Task 2: Develop rPPG Extraction Submodule of Pipeline Control System**

* **Objective:** Develop a system to take output of preprocessing submodule, select a focus area and in real-time produce PPG signals.
* **Process:**
  + Research state-of-the-art methods for real-time PPG extraction from images and video streams. [[Recent Paper](https://www.nature.com/articles/s41598-022-11265-x)].
  + Replicate PPG extraction method of [[Recent Paper](https://www.nature.com/articles/s41598-022-11265-x)] in offline mode.
  + Convert PPG extraction method of [[Recent Paper](https://www.nature.com/articles/s41598-022-11265-x)] to real-time (online mode).
* **Return Deliverables:**
  + Detailed documentation/write-up of implementation of rPPG Extraction Submodule.
  + Software for graphing PPG in real-time from live video stream and recorded video.
  + Updated executable and script of rPPG extraction submodule

**Task 3: Ensure Consistent PPG Signals for Same Recorded Video Feeds**

* **Objective:** Ensure for the same pre-recorded video and target area, current pipeline control system produces similar PPG signal.
* **Process:**
  + Implement submodule to store generated PPG signals for each video stream.
  + Run pipeline on recorded and saved videos N-times.
  + Compare similarity between generated PPG signals for each video using: cross-correlation, standard deviation (or variance), and mean (or median).
* **Return Deliverables:**
  + Graphs of results from cross-correlation and other methods.

**Task 4: Implement algorithm for computing HR from rPPG signals**

* **Objective:** Develop algorithm for computing heart rate (HR) from rPPG signals
* **Process:** 
  + Review and select best methods from [[Review article]](https://link.springer.com/article/10.1007/s11831-021-09597-4) and [[A Recent Method]](https://www.mdpi.com/2079-6374/12/2/82).
  + Test algorithm on generated and stored rPPG signals.
  + Visual evaluation of algorithm performance.
  + Integrate algorithm into pipeline control system.
  + Test all pipeline control system on existing video rPPG datasets and on real time video stream.
* **Return Deliverables:**
  + Complete script of pipeline control system.
  + Final software application [if required].
  + Comprehensive documentation outlining the implementation details, testing  
    procedures, and performance evaluation metrics. *[This will proceed as we progress on the project]*

**TIMELINE**

I would appreciate if we agree that these timelines can become shorter or longer based on the quality of results as we progress on the project

Weeks 1: Research Phase for all tasks.

Weeks 2-4: Design and test of video collection and preprocessing submodule.

Weeks 4-5: Design and test of rPPG extraction submodule.

Weeks 7-8: Design and test of HR computation submodule.

Weeks 8-11: Documentation Phase.