# **Project Documentation**

| **School/Organisation:**  *(Leave blank if private)* | St. Andrew’s Secondary School |
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| **Team Name:** |  |
| **Team Members:** | - Anand Ram Sanjith - Anish - Hayden Chua |
| **Project Title:** | RoboStudy buddy |
| **Problem Statement:**  *What problem are you trying to solve?* | Students studying alone at home face distractions and low motivation. Lack of structure reduces productivity. Difficult for teachers and parents to monitor focus remotely. |
| **Project Description:**  *How does this project work? What is this project supposed to do?*  *You may attach photos/drawings/circuit diagrams/flowcharts here* | **💡 Our Solution**   * - An AI-powered tabletop study companion. * - Combines productivity tools, smart sensors, and gamification. * - Helps students build better habits through personalized support.   **✨ Key Features**  **⏱️ Pomodoro Timer**   * - Uses the Pomodoro Technique to alternate study and break periods. * - 25-minute study sessions followed by 5-minute breaks. * - Longer 15–20 minute breaks after 4 Pomodoros. * - WRGB LEDs change color to indicate session phases. * - Break detection system confirms that the user is resting. * - Lighting system notifies when the break is over. * - Hardware: Controlled by a raspberry pi, interfaced with WRGB LED strips, and powered by USB-C power.   **🌈 Intelligent Lighting System**   * - RGB LEDs simulate the full color spectrum. * - Individually addressable LEDs controlled via GPIO. * - Red flashing lights activate when the user loses focus. * - Reduces wiring from 5 to 3 connections for hardware efficiency. * - Hardware: WS2812B LEDs connected to raspberry pi via GPIO pin, with capacitor/resistor circuit for protection and power supply.   **🤖 AI Study Assistant**   * - Offers real-time explanations, summaries, and brainstorming help. * - Supports both voice and text input for accessibility. * - Integrates APIs from OpenAI or Perplexity for intelligent responses. * - Runs on Raspberry Pi 5 with Wi-Fi for cloud communication. * - Uses a microphone via USB for voice input. * - Audio output via speaker or audio module. * - Adapts to user preferences in tone and format over time.   **📹 Distraction Detection + Vibration Alarm**   * - Camera with eye-tracking detects loss of focus. * - Triggers voice alerts and vibrations when distractions are noticed. * - Flashing LEDs reinforce attention redirection. * - Future concept: non-invasive mind-reading system for cognitive feedback. * - Ethical design: no data stored for more than 5 minutes. * - Hardware: USB camera module, vibration motor module.   **📊 Personalized Study Coach**   * - Tracks Pomodoro sessions, focus patterns, and breaks. * - Suggests optimal study schedules based on collected data. * - Learns from usage habits to provide personalized tips. * - Stores data locally. * - Feedback via LEDs, vibration motors, or on-screen alerts. * - Predicts ideal study times and strategies. * - Integrates with mobile apps or desktop dashboard.   **🎮 Gamified Focus System**   * - Users earn "Focus Points" for completed study blocks. * - Points unlock rewards like playlists, motivational messages, or break activities. * - Reinforces consistency through daily/weekly streaks. * - Uses dopamine-based reward loops to make studying engaging. * - Builds long-term habits through behavioral psychology. * - Turns discipline into a fun challenge. * - Hardware: Points and streaks tracked in software; rewards trigger audio, light effects, or access via app; optional buzzer or haptic motor for celebration cues.   **📈 Productivity Dashboard**   * - Visual dashboard with graphs, heat maps, and timelines. * - Shows study streaks, Pomodoro counts, and peak performance times. * - Identifies distraction patterns and productive windows. * - Allows custom study goals and real-time tracking. * - Encourages accountability through data-driven motivation.   **🗣️ Voice Control Mode**   * - Set timers, ask questions, and log goals by voice. * - Uses USB microphones for input. * - Wake word detection (e.g., “Hey Buddy!”) to activate. * - Outputs feedback via speaker or LED indicators. * - Backup control through physical buttons or mobile interface. * - Enables hands-free use for uninterrupted studying. |
| **Hardware Components Used:** | 🔧 Hardware Components List🧠 Core Controller  * **Raspberry Pi 5** (Main control unit) * **MicroSD Card (32GB or higher)** (For OS and data storage) * **USB-C Power Supply (5V 3A min)**  💡 Lighting System  * **WS2812B Individually Addressable RGB LED Strip** * **Capacitor (1000 µF, 6.3V or higher)** * **Resistor (330–470Ω)** (for data line protection) * **Jumper wires / Connectors**  ⏱️ Pomodoro Feedback + Alerts  * **Vibration Motor Module** * **Passive Buzzer (optional, for reward cues)**  🎤🔊 Voice & Audio System  * **USB Microphone** (for voice input and wake-word detection) * **Mini Speaker / USB Audio Output Module**  📷 Distraction Detection  * **USB Camera Module**  🔄 Control & Backup  * **Push Buttons** (for manual input, e.g., timer start/stop) * **LED Indicators** (for mode/status feedback)  🔋 Power & Protection  * **Power Distribution Board or Breadboard (for prototyping)** * **Voltage Regulator (if needed for LED or motors)** * **Optional: Rechargeable Battery Pack or UPS HAT** for portable use |
| **Software program codes/screenshots**  *You may copy paste in the program codes or screen shots. Or you may submit as separate attachments.* |  |
| **Possible Improvements**  *How can you take this project further so that it can better solve the stated problem?* | **Future Developments**  **📅 Smart Scheduler**   * - Syncs with calendar to analyze deadlines and workload. * - Recommends study windows based on energy levels. * - Adjusts sessions dynamically to handle unexpected changes. * - Uses time-blocking and adaptive scheduling for balance. * - Prevents burnout with intelligent workload distribution.   **🔗 App & Tool Integration**   * - Connects with Google Calendar, Notion, Anki, and more. * - Tracks study goals across multiple platforms. * - Enables notifications, progress syncing, and task updates. |