
Design Review 4



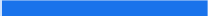
LAB 2 GROUP 9

(aka. Bandwidth Bandits)

Team Profiles



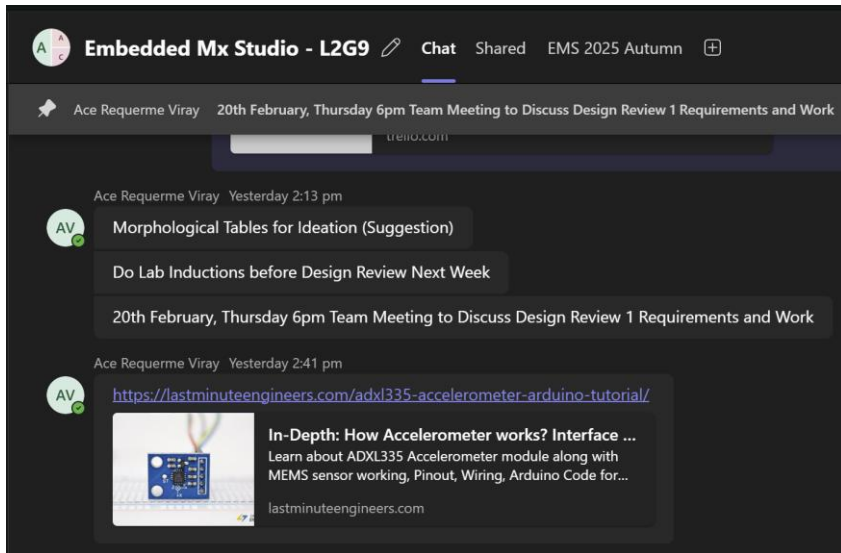
Ace Viray	Sophie Vuillemin	Claudia	Amadee Thotawatta
Team Lead	Electrical Lead	Software Lead	Mechanical Lead
Microcontroller Subcircuit	Analog Filter Subcircuit	Accelerometer Interface Subcircuit	Power Supply Subcircuit
Pace Identification	Step Count Routine	Calibration Routine	Self-test Routine



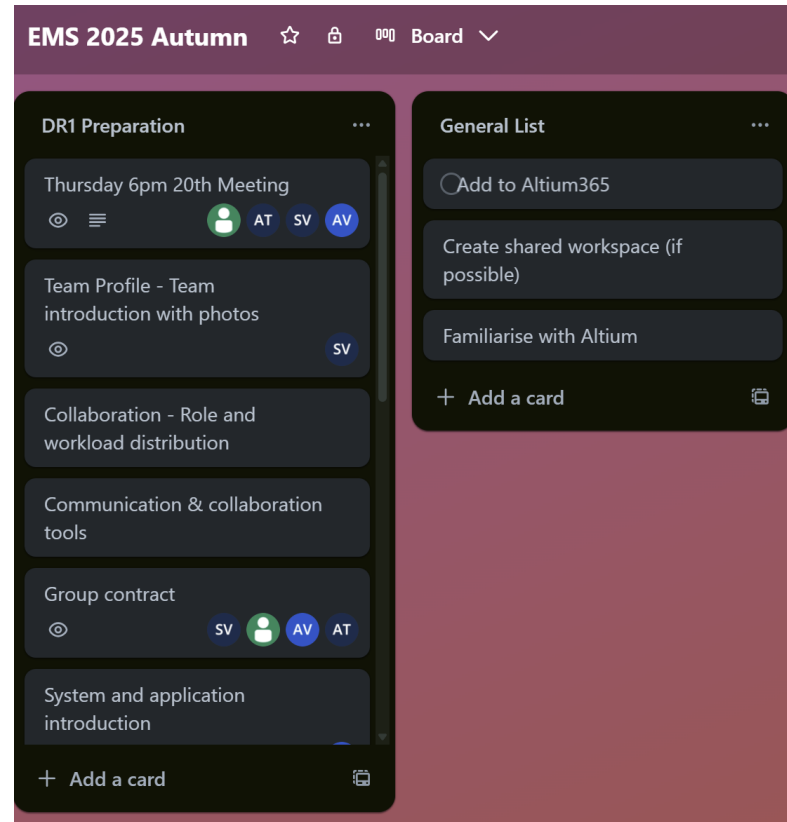
Team Collaboration & Communication

Communication & Collaboration Tools

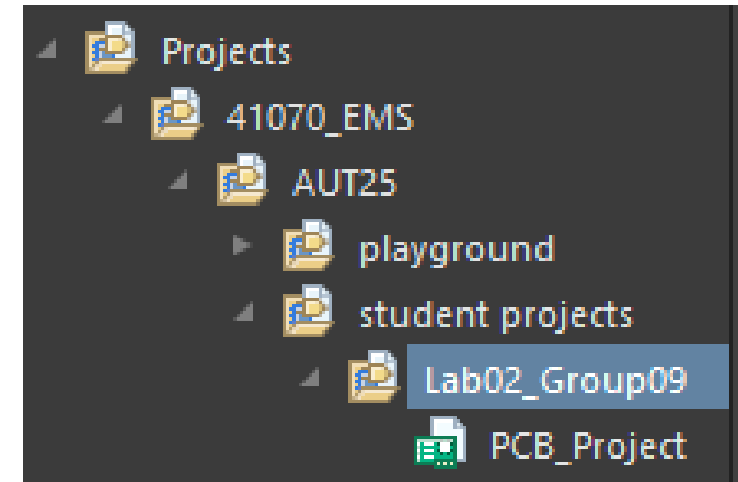
1. **Teams**: File Sharing & Comms



2. **Trello**: Delegation



3. **Altium365**: PCB Cloud





System Overview and Specifications

System Introduction

The Step-Counter System is a project collaboration between software, electronics (ECAD) and mechanical (MCAD) systems.



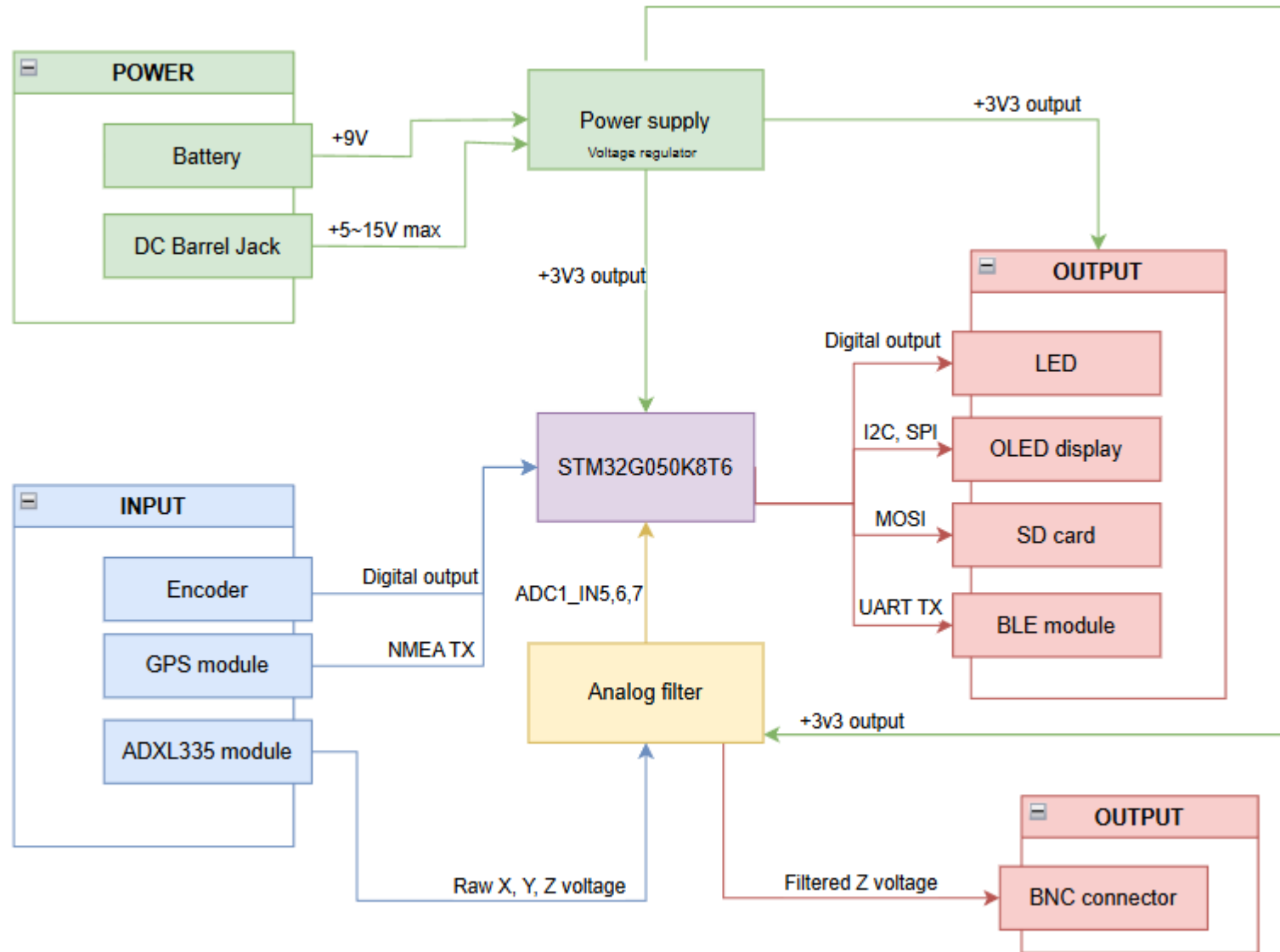
Functional and Hardware Requirements List

Functional Requirement	Hardware Requirement	Choice	Justification
Process ADXL335 Data	<ul style="list-style-type: none">• Number of GPIO Pins• Number of ADC Capable Pins• ADC Resolution• Flash Size	<ul style="list-style-type: none">• STM32G050K8T6 Microcontroller – LQFP32 Package with 64kB of Flash Size.	<ul style="list-style-type: none">• Used before in previous subject• Industry Standard• 32 GPIO Pins• 10 ADC Capable Pins• 64kB Flash should be enough for software routines
Provide power to the system	<ul style="list-style-type: none">• Internal power supply• External power supply	<ul style="list-style-type: none">• Non-rechargeable 9V battery• DC Barrel Jack for External	<ul style="list-style-type: none">• Compact in size• Simple to use• Easily available and standardised
Provide appropriate voltage to system components	<ul style="list-style-type: none">• Power requirements of PCB components (microcontroller, ADXL335)• Voltage regulator	<ul style="list-style-type: none">• LD1117S33CTR Linear 3.3V Low-dropout voltage regulator	<ul style="list-style-type: none">• Provides stable 3.3V output• Integrated protection features• Low output noise

Functional and Hardware Requirements List

Functional Requirement	Hardware Requirement	Choice	Justification
Provide for user inputs to the system	<ul style="list-style-type: none"> Size 	<ul style="list-style-type: none"> Mechanical Encoder with integrated button 	<ul style="list-style-type: none"> Easy to use and implement Button is used for selecting different features available
Provide visual outputs from the system to the user	<ul style="list-style-type: none"> Size Power consumption Operating voltage 	<ul style="list-style-type: none"> 0.96" OLED Display Indicator LEDs, RGB for walking pace identification 	<ul style="list-style-type: none"> Compact size, lightweight Low power consumption SMD LED vs through-hole LEDs (smaller footprint) RGB to have multiple colours
Provide signal conditioning (analog filtering) for accelerometer	<ul style="list-style-type: none"> Type Order Cut-off frequency 	<ul style="list-style-type: none"> Butterworth (circuit topology) Sallen Key (filter topology) Second order 	<ul style="list-style-type: none"> Maximum flat bandpass Unity gain

System Block Diagram





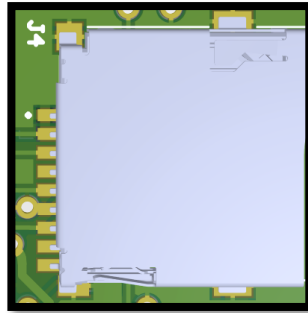
PCB Innovation & Creativity

Innovative PCB features:



U.fl connector
instead of SMD BNC

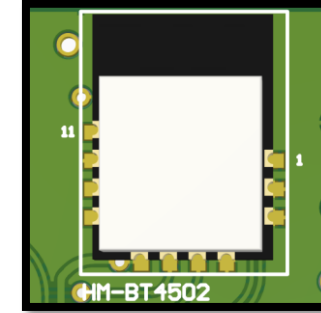
Creative design:



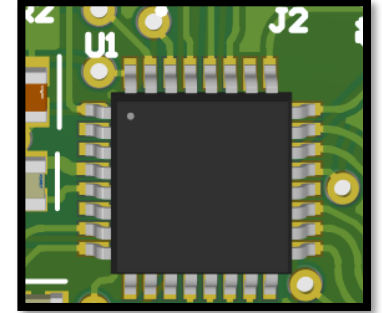
SD card



GPS module



Bluetooth BLE
Module



Embedded
STM chip

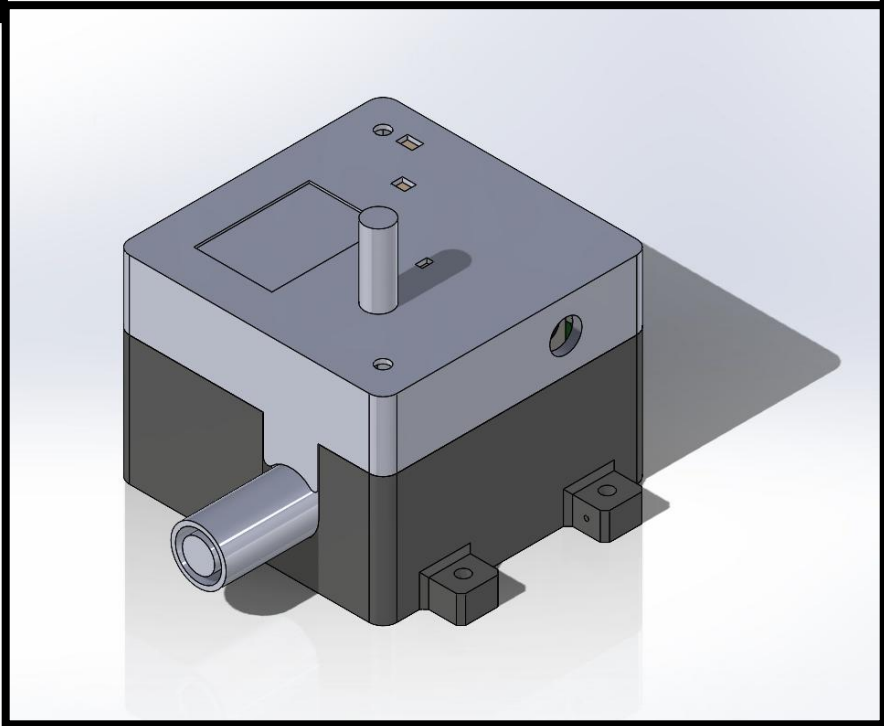
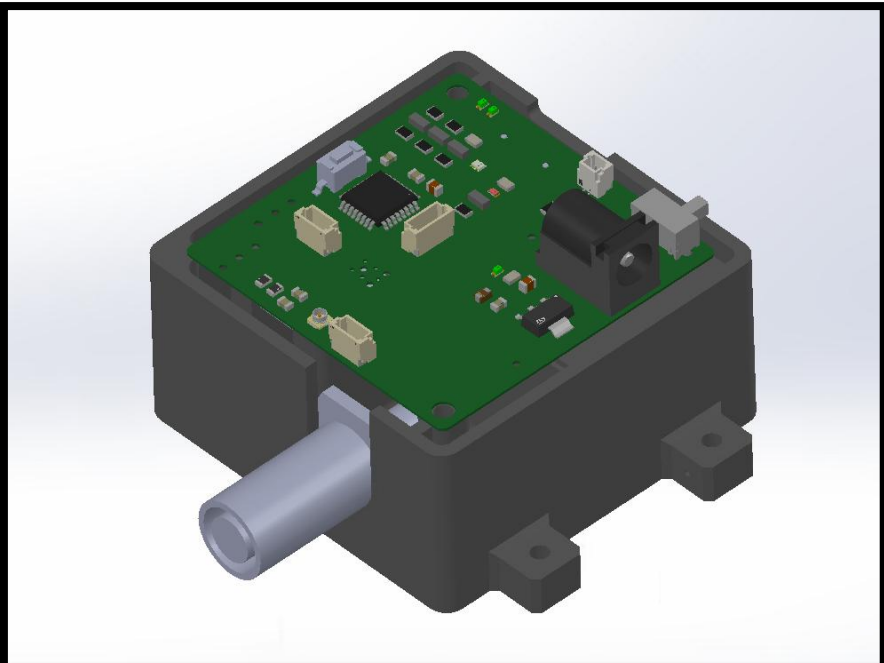
User experience:

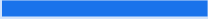


Smaller form factor -> enhanced user experience



Enclosure Innovation and Creativity





Embedded Software Innovation and Creativity

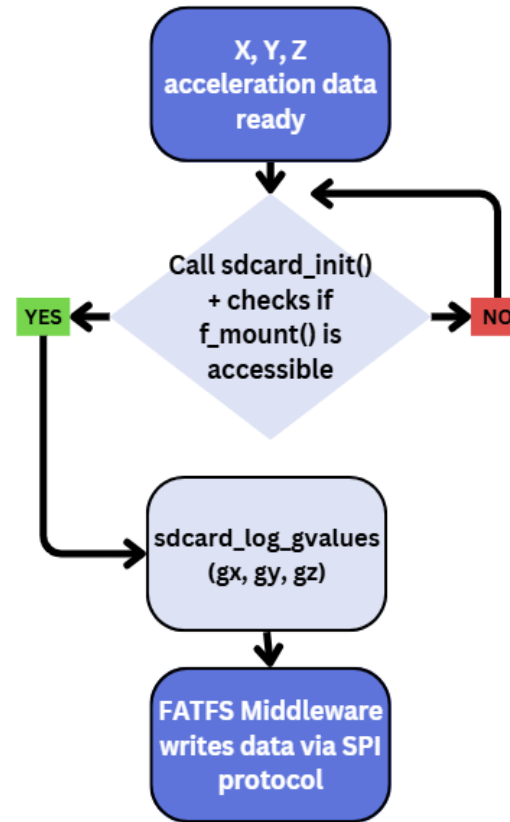
Innovative PCB features & creative design:



Bluetooth BLE Debugger Working

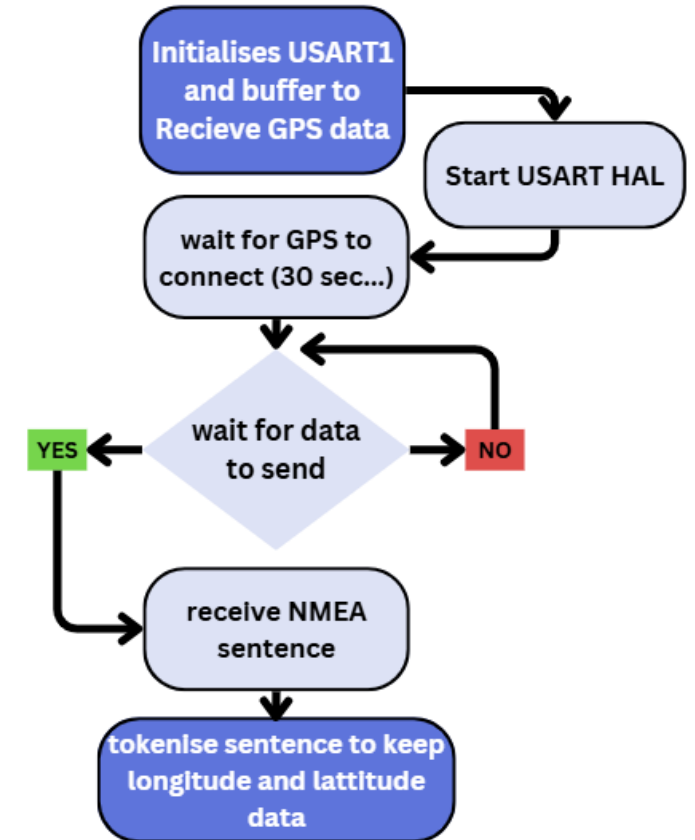
User experience:

Accessible via android and laptop



SD Card Process

Storing Acceleration Data



GPS Module

Extra Feature for Step Tracking

Innovative PCB features & creative design:

```
50 typedef enum
51 {
52     LOGO,
53     MAIN_MENU,
54     HELP_MENU_1,
55     HELP_MENU_2,
56     HELP_MENU_3,
57     ADXL_SELFTEST,
58     ADXL_CALIBRATION,
59     ADXL_STEPCOUNT,
60     BLUETOOTH,
61     SD
62 } UserInterfaceState_t;
```

Enum display OLED

```
100 typedef struct //this struct goes into
101 {
102     uint8_t current_state;
103     UserInterfaceState_t ui_state;
104     TIM_HandleTypeDef* htim_encoder;
105     TIM_HandleTypeDef* htim_timer;
106     UART_HandleTypeDef* huart_;
107
108     uint16_t millis_counter;
109     uint16_t prev_time;
110     uint16_t bluetooth_time;
111
112     Encoder_t encoder;
113     Bluetooth_t bluetooth;
114
115 } UserInterface_t;
```

Compact size

```
sensor->mV_value[i] = (sensor->adc_value[i] * V_in) / adcResolution;
sensor->g_value[i] = (sensor->mV_value[i] - mV_zero_g_bias[i]) / sensitivity_XYZ;
```

Pointers

```
Core
├── Inc
│   ├── ADXL335.h
│   ├── main.h
│   ├── ssd1306_conf.h
│   ├── ssd1306_fonts.h
│   ├── ssd1306.h
│   ├── stepcounter.h
│   ├── stm32g0xx_hal_conf.h
│   ├── stm32g0xx_it.h
│   └── UserInterface.h
├── Src
│   ├── ADXL335.c
│   ├── main.c
│   ├── ssd1306_fonts.c
│   ├── ssd1306.c
│   ├── stepcounter.c
│   ├── stm32g0xx_hal_msp.c
│   ├── stm32g0xx_it.c
│   ├── syscalls.c
│   ├── systemem.c
│   ├── system_stm32g0xx.c
│   └── UserInterface.c
```

Classes



Evaluation, Feedback and Reflection

Presentation Quality and Delivery	Expert Presentation is professional, well-organized, succinct, and detailed, demonstrating a comprehensive understanding of the topic. Visual aids are exceptionally well-designed, clear, and seamlessly integrated into the presentation. Time management is excellent, with the presentation staying well within the allotted timeframe. Speaker's words are consistently clear, technically correct and easy to understand.	Proficient Presentation is mostly well-organized, succinct, and detailed, demonstrating a good understanding of the topic. Visual aids are well-designed and clear, supporting the content effectively. Time management is good, with the presentation staying within the allotted timeframe with only minor deviations. Speaker's words are mostly clear, easy to understand, and technically correct.	Developing Presentation is somewhat organized and detailed but lacks conciseness and may contain some minor inconsistencies. Visual aids are adequate but may lack clarity or relevance in certain areas. Time management is fair, with occasional deviations from the allotted timeframe. Speaker's words are generally clear, but there may be occasional difficulties in understanding or technical accurateness.	Novice Presentation lacks organization and detail, with significant deficiencies in understanding the topic. Visual aids are poorly designed, unclear, or irrelevant to the content. Time management is poor, with substantial deviations from the allotted timeframe. Speaker's words are often unclear, difficult to understand, or technically incorrect.
Team Profile, Collaboration & Communication	Expert The team profile is exceptionally well presented and covers all the required content in a professional manner. The group has established a clear and effective group structure, with each member contributing meaningfully to the project. Roles are fully defined, communication/collaboration tools are used and described.	Proficient The team profile is complete and well presented and covers all required content. The group has established a sufficient group structure, but there are some areas for improvement in terms of member contributions and group dynamics. Roles are defined, communication/collaboration tools are described.	Developing The team profile is presented, but there are areas that could be improved in regard to the required content. The group has not established a clear or effective group structure, and/or some members are not contributing meaningfully to the project. Roles may be underdefined.	Novice The team profile is incomplete or missing key information of the required contents. The group lacks a clear or effective group structure, and several members are not contributing meaningfully to the project.

System Overview and Specifications	Expert A comprehensive and detailed overview of the system is presented, covering all key components and functionalities (system architecture, hardware, software). A clear and comprehensive set of requirements in the form of tables/lists is presented with detailed and precise system block diagrams.	Proficient An overview of the system is presented, addressing most key components and functionalities (system architecture, hardware, software). A sufficient but partially incomplete set of requirements in the form of tables/lists is presented. System block diagrams are presented but lack details and/or there is room for improvement.	Developing A basic overview of the system is presented, covering essential components and functionalities, but lacking detail of the system architecture, hardware, and/or software. A limited set of requirements is presented and system block diagrams are underdeveloped but mostly complete.	Novice A superficial or incomplete overview of the system is presented with missing key components and/or functionalities. There is a significant lack of understanding and/or inaccuracies/omissions in the system architecture, hardware, and/or software. Requirements and/or system block diagrams are incomplete or missing entirely.
PCB Innovation and Creativity	Expert The PCB design demonstrates exceptional innovation and creativity, showcasing original solutions to the design challenge. Creative features enhance functionality and user experience, setting the design apart from conventional approaches.	Proficient The PCB design shows good innovation and creativity, incorporating original solutions to the design challenge. Creative features contribute positively to functionality and user experience, adding value to the design. The design effectively handles design challenges with a balance of complexity and simplicity.	Developing The PCB design exhibits some innovation and creativity, although improvements could be made in originality and uniqueness. Creative features offer moderate enhancements to functionality and user experience. The design adequately addresses the design challenge, although some areas may lack complexity or sophistication in approach.	Novice The PCB design lacks innovation and creativity, with few original solutions to the design challenge. Creative features are absent or minimal, offering little value to functionality and user experience. The design struggles to address design challenges effectively, lacking complexity or sophistication in approach.

Enclosure Innovation and Creativity	Expert The enclosure design demonstrates exceptional innovation and creativity, showcasing original solutions to the design challenge. Creative features enhance functionality and/or user experience, setting the design apart from conventional approaches.	Proficient The enclosure design shows good innovation and creativity, incorporating some original solutions to the design challenges. Creative features contribute positively to functionality and/or user experience, adding value to the design.	Developing The enclosure design exhibits some innovation and creativity, although improvements could be made in originality and uniqueness. Creative features offer moderate enhancements to functionality and/or user experience.	Novice The enclosure design lacks innovation and creativity, with few original solutions to the design challenge. Creative features are absent or minimal, offering little value to functionality and/or user experience.
Embedded Software Innovation and Creativity	Expert The embedded software design demonstrates exceptional innovation and creativity, showcasing original solutions to the design challenge. Creative features enhance functionality and user experience, setting the design apart from conventional approaches.	Proficient The embedded software design shows good innovation and creativity, incorporating original solutions to the design challenge. Creative features contribute positively to functionality and user experience, adding value to the design.	Developing The embedded software design exhibits some innovation and creativity, although improvements could be made in originality and uniqueness. Creative features offer moderate enhancements to functionality and user experience. Limited novel approaches are employed, demonstrating potential for further innovation.	Novice The embedded software design lacks innovation and creativity, with few original solutions to the design challenge. Creative features are absent or minimal, offering little value to functionality and user experience.
Evaluation, feedback & reflection	Expert The group evaluation aligns with the assigned competency levels by the mentors. The team demonstrates a comprehensive understanding of the feedback received and has clearly highlighted actions taken to address areas for improvement.	Proficient The group evaluation mostly aligns with the assigned competency levels by the mentors. The team demonstrates an adequate understanding of the feedback received and has outlined some actions taken to address areas for improvement.	Developing The group evaluation was not completed or mostly does not align with the assigned competency levels by the mentors. The team demonstrates a limited understanding/ability to incorporate the feedback received and/or does not clearly outline actions taken to address areas for improvement.	Novice The group evaluation is mostly misaligned with the assigned competency levels by the mentors. The team does not demonstrate an understanding of the feedback received and does not outline or show any evidence of actions taken to address areas for improvement.