EDL MON-21

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Feedback from milestone-1 & Action taken

1. Reviewer's Feedback:

- During Milestone 1, our Team Reviewer pointed out that the algorithm used for synchronisation was not mentioned in our documentation.

2. Clarification from Team Guide :

- Upon seeking clarification, professor Mukul informed us that synchronisation details are not required at this stage.
- Instead, he provided three research papers related to controlling the flash mechanism using a microcontroller and an RC circuit-inspired approach.

3. Understanding the Flash Control Mechanism:

- The Microcontroller is responsible for implementing the RC circuit-like behaviour.
- The Microcontroller modulates the charging and discharging cycle , ensuring that the LED flashes at the desired intervals and turns off suddenly.
- This process mimics the characteristic exponential charging curve of an RC circuit , creating a controlled and predictable flash cycle.

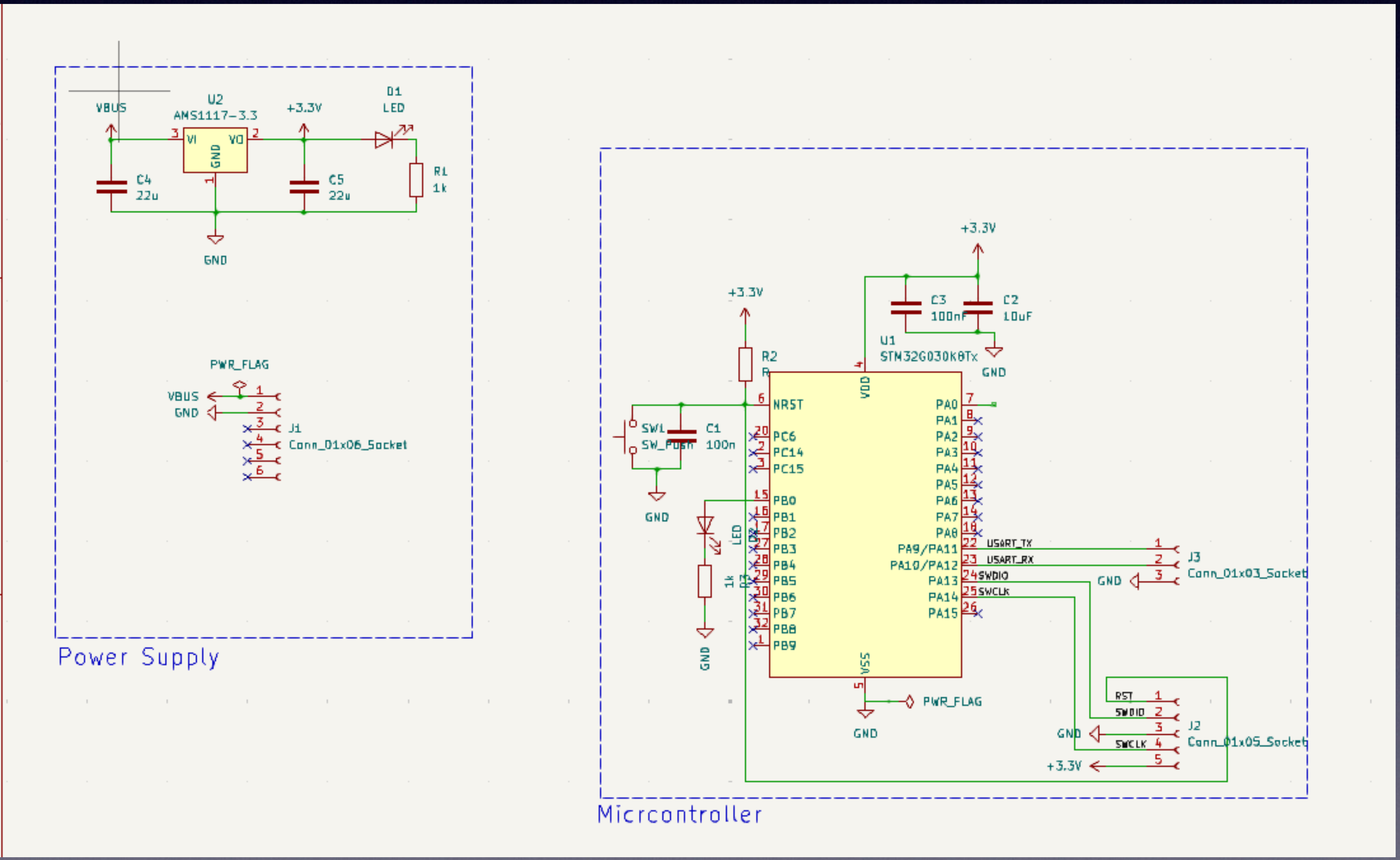
4. Incorporation in Milestone 2:

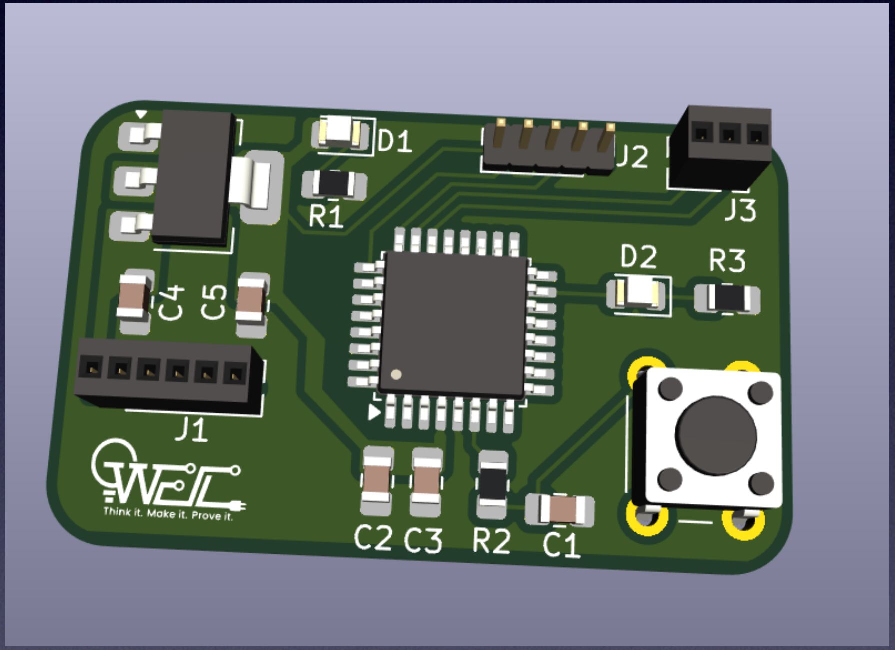
- We have studied the given research papers and incorporated relevant insights into our updated documentation.

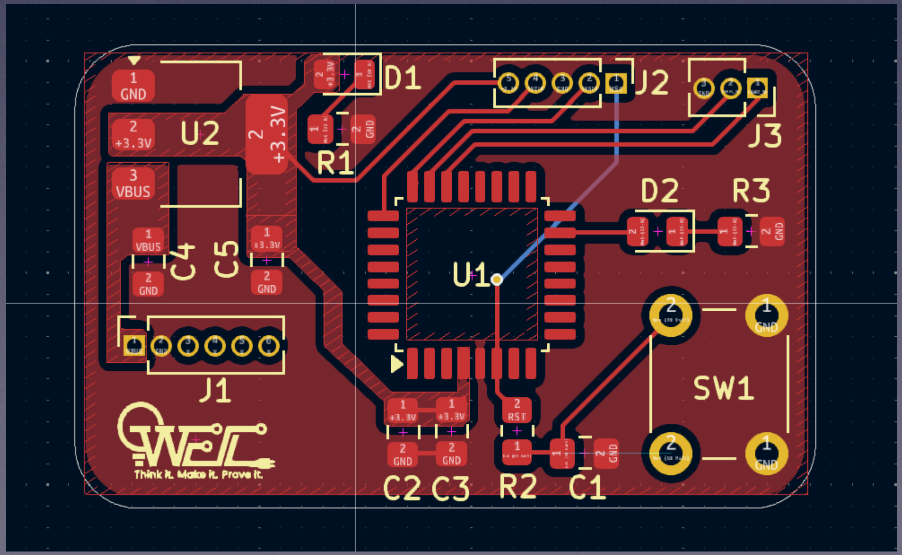
Progress evaluation against test plan

We have successfully developed **Version 1 and Version 2** of both the **schematic and PCB design**.

The **FIRST** version served as an initial prototype, allowing us to validate the fundamental design and component placement.

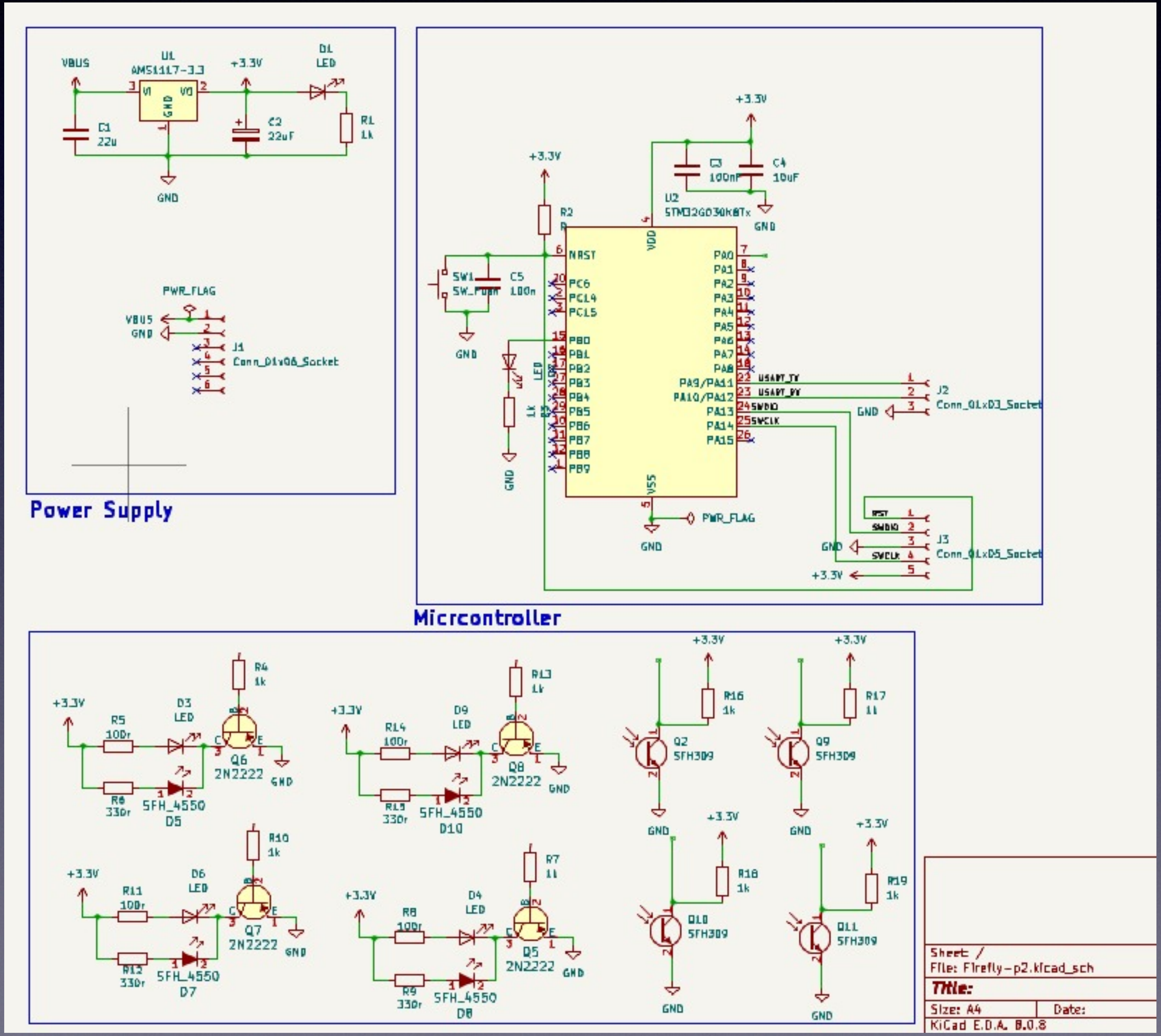






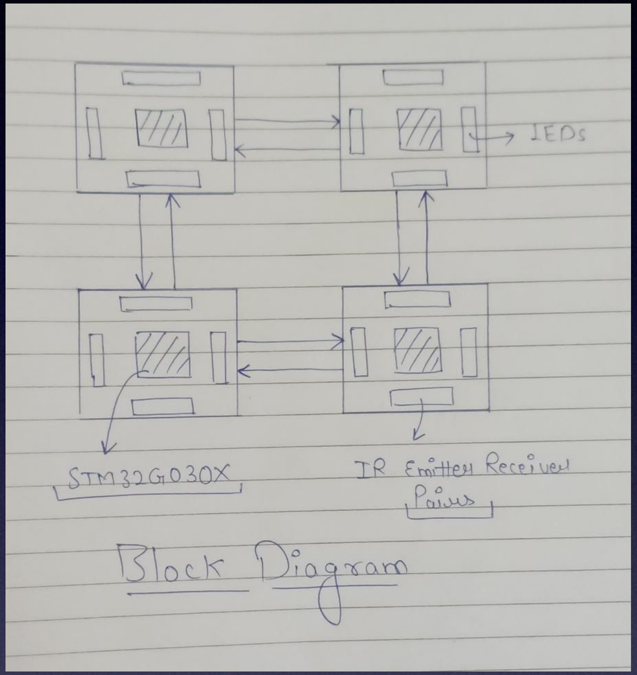
Based on our observations and feedback, we made necessary refinements and improvements, leading to Version 2.

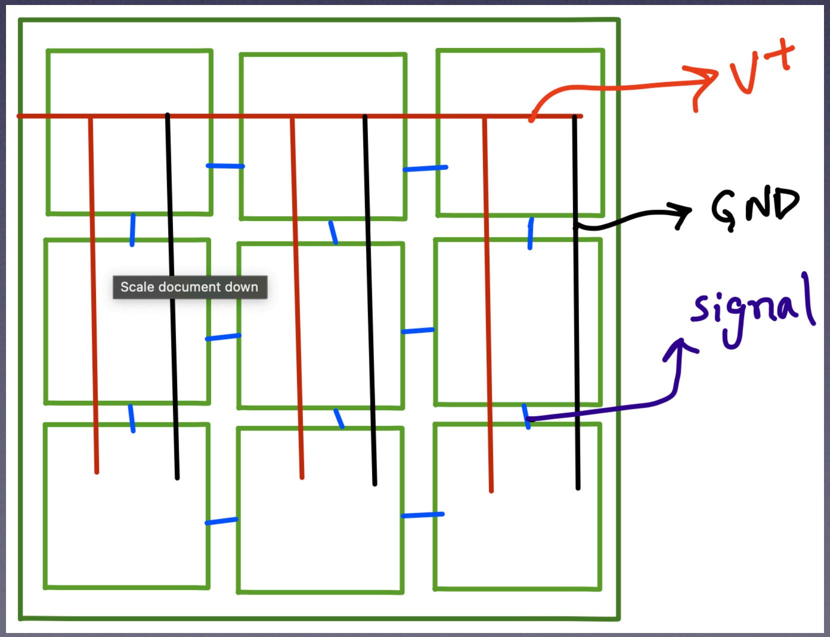
This updated version incorporates optimisations for better performance, reliability, and layout efficiency, bringing us closer to a finalised design.



Block Diagram Overview

The block diagram represents the key subsystems involved in simulating **firefly synchronisation**, detailing their **principle of operation, signal conditioning, voltage/current levels, and communication protocols**.





Microcontroller Unit (STM32G030x)

- **Principle of Operation:**
  - Serves as the core controller for the firefly synchronisation simulation.
  - Implements the RC circuit-inspired timing mechanism in software to regulate LED flashes.
  - Uses internal timers to generate precise flashing intervals based on the synchronisation algorithm.
- **Signal Conditioning:**
  - Utilises timers (TIMx) to control LED blinking with precise timing.
  - Configures GPIOs for LED driving and communication with other units if needed.
  - Implements interrupt-based synchronisation to handle incoming pulses from neighbouring fireflies.
- **Key Voltage & Current Levels:**
  - Operates at 3.3V, with GPIO logic levels matching the same voltage.
  - LED driving through GPIOs with current-limiting resistors to maintain safe operation.
- **Signal Protocols:**
  - Uses PWM (Pulse Width Modulation) via TIM peripherals to control LED brightness and flashing pattern.
  - External interrupts (EXTI) can be utilised for detecting synchronisation pulses.

The 9 pcbs will be mount on a base board which will be connected via the V+ voltage and a common ground

Firefly Synchronisation - Simple Explanation

1. **Each firefly has its own timer**
    - Imagine every firefly has a tiny clock inside.
    - This clock slowly counts up, and when it reaches a limit, the firefly **flashes**.
2. **Flashing and Resetting**
    - When a firefly flashes, it resets its clock to zero and starts counting up again.
3. **Fireflies Copy Each Other**
    - If a firefly sees another one flash nearby, it **adjusts its own timing** slightly to match.
    - If it's close to flashing, it **flashes sooner**.
4. **Chain Reaction**
    - As more fireflies copy each other, their flashes start lining up.
    - Over time, they all **flash together in sync**.
5. **End Result**
    - At first, the flashes are random.
    - Slowly, they start getting closer.
    - After a while, all fireflies flash at **the exact same time**—without any central control.