

## Introduction

This project aims to eliminate potential failure points by replacing the wired components with a compact wireless transmitter attached directly to the blade, communicating with a receiver at the scoring machine

### Potential Consequences

#### Positive

- Reduced equipment setup time
- Reduced tripping and safety hazard
- Lower operation cost for large tournaments

#### Negative

- Signals in large venues may be susceptible to interference from other bouts
- Widespread adoption could render existing wired equipment useless, creating financial burden
- Signals could be intercepted, causing integrity concerns

## Objectives

### Quantitative

- 2.92 V DC
- 10-20 ms response time
- 20 g attachment
- 40x40x15mm attachment
- 36 hr battery life
- Minimum 20m range with high interference

### Qualitative

- Functional prototype
- Strong attachment
- Durability
- Comfort
- Easy to recharge/replace battery

## Approach

Six different radio modules (Fig. 1) were tested before arriving at the current design. Each version was tested for response time, range (with and without interference), size, and signal reliability.

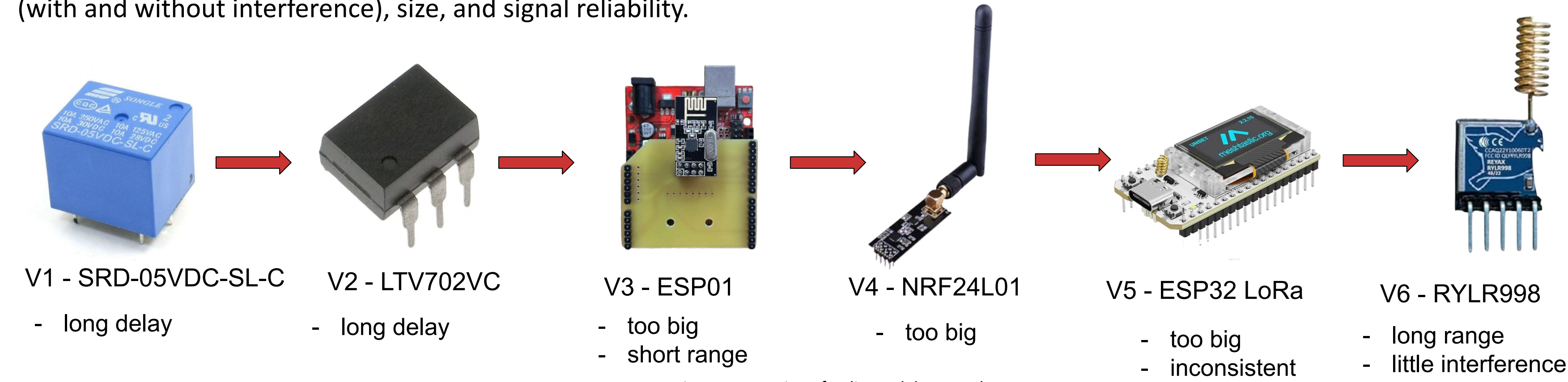


Fig 1 - progression of radio modules tested

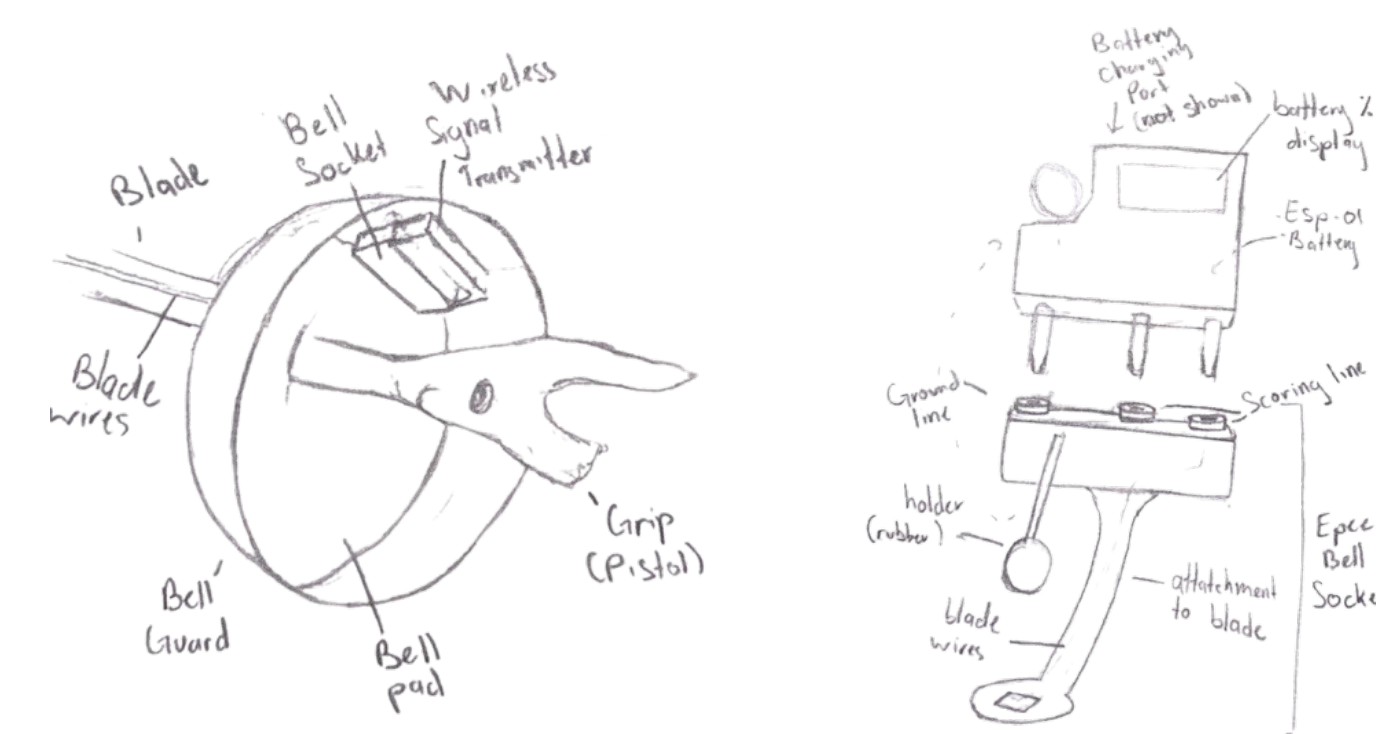


Fig 2 - technical sketch of transmitter application

The transmitter is designed to plug directly into the bell guard socket (Fig 2), replacing the body cord connection



Fig 3 - current prototype of transmitter

The current prototype (Fig. 4) utilizes a Digispark ATTiny85 Microcontroller and a REYAX RYLR998 LoRA radio module mounted on a PCB.

The ATTiny85 and RYLR998 were chosen for their compact size, low power consumption, and long range transmission capabilities.

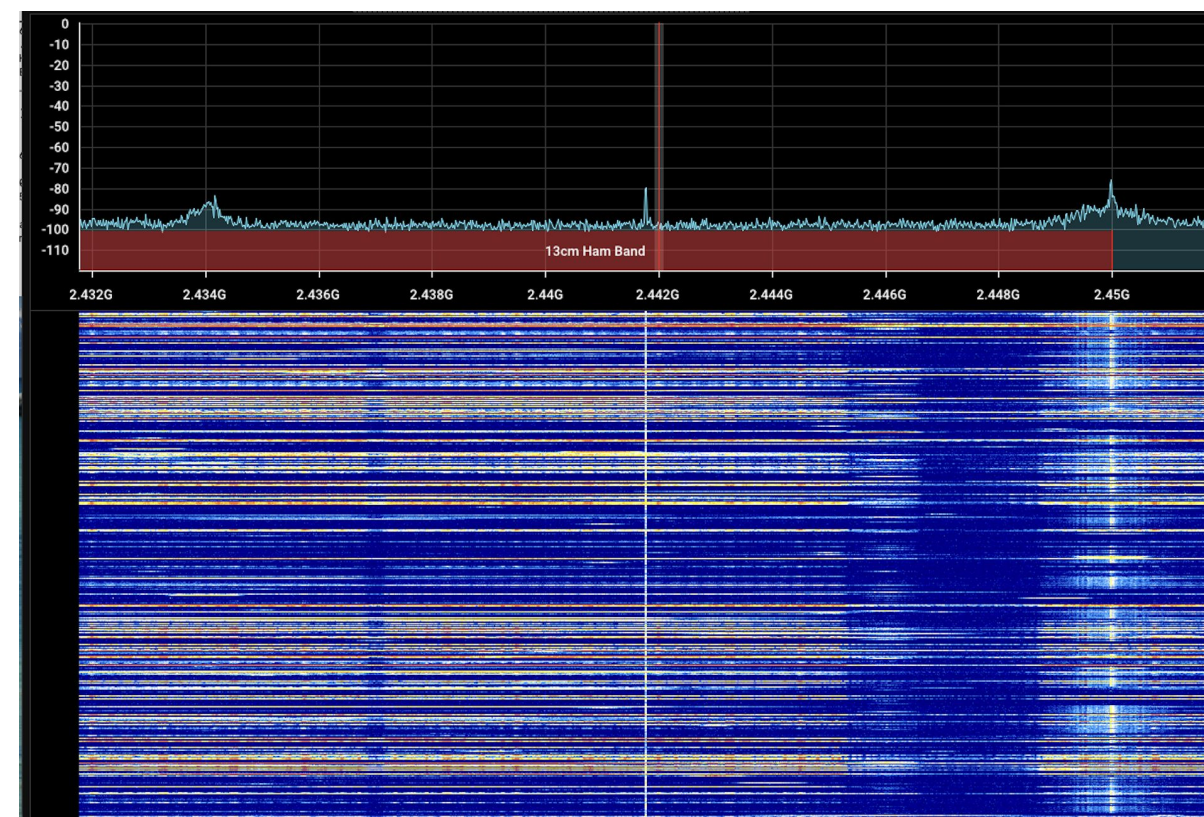


Fig 4 - all transmissions at 2.442,000,000 (2.4 GHz) - frequency used for wifi

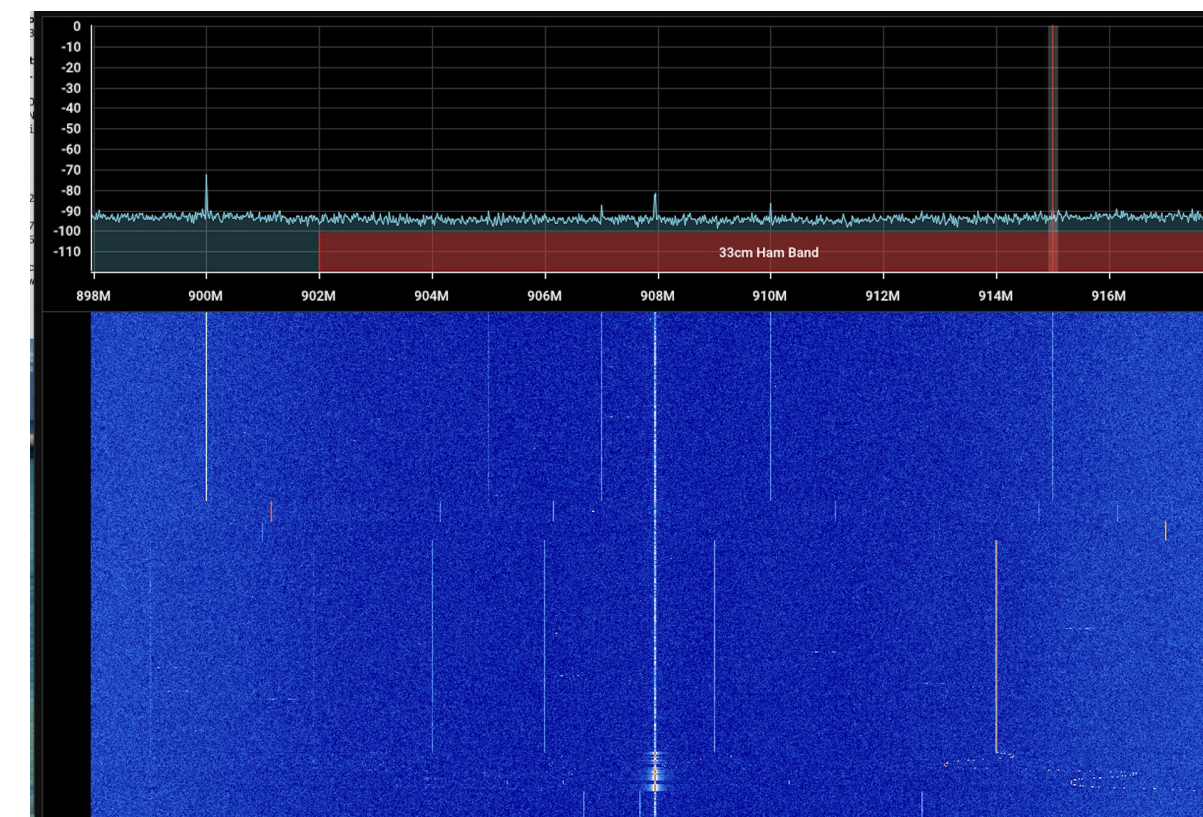


Fig 5 - all transmissions at 915,000,000 (915 MHz) - frequency used for RYLR998

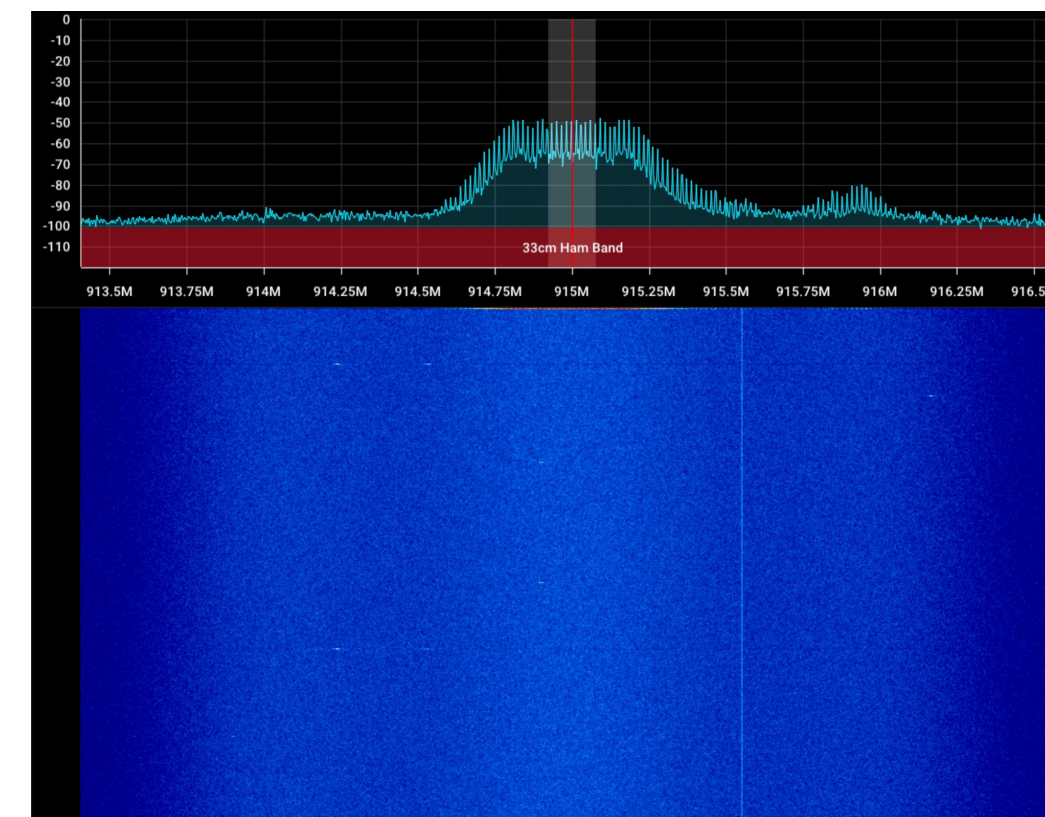


Fig 6 - all transmissions at 915 MHz when transmitter is used

One of the frequencies that wifi commonly works on is 2.4GHz, making this frequency very noise (Fig. 4). The frequency that the REYAX RYLR998 works at in the US is 915 MHz, which has significantly less interference affecting the transmitter (Fig. 5). In Fig 6, when the transmitter is used, there is a strong distinguishable transmission with no noise

## Timeline

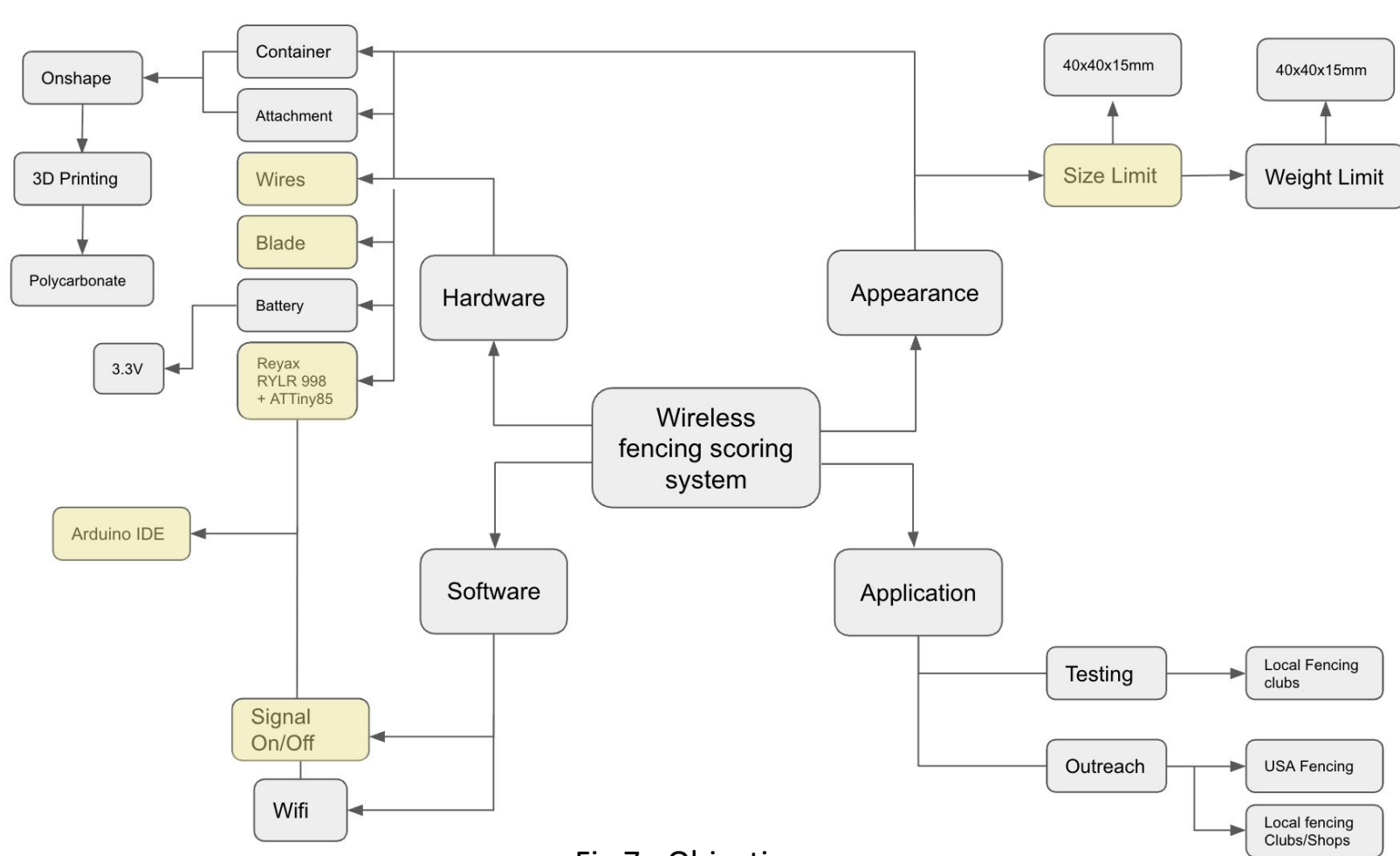


Fig 7 - Objective map

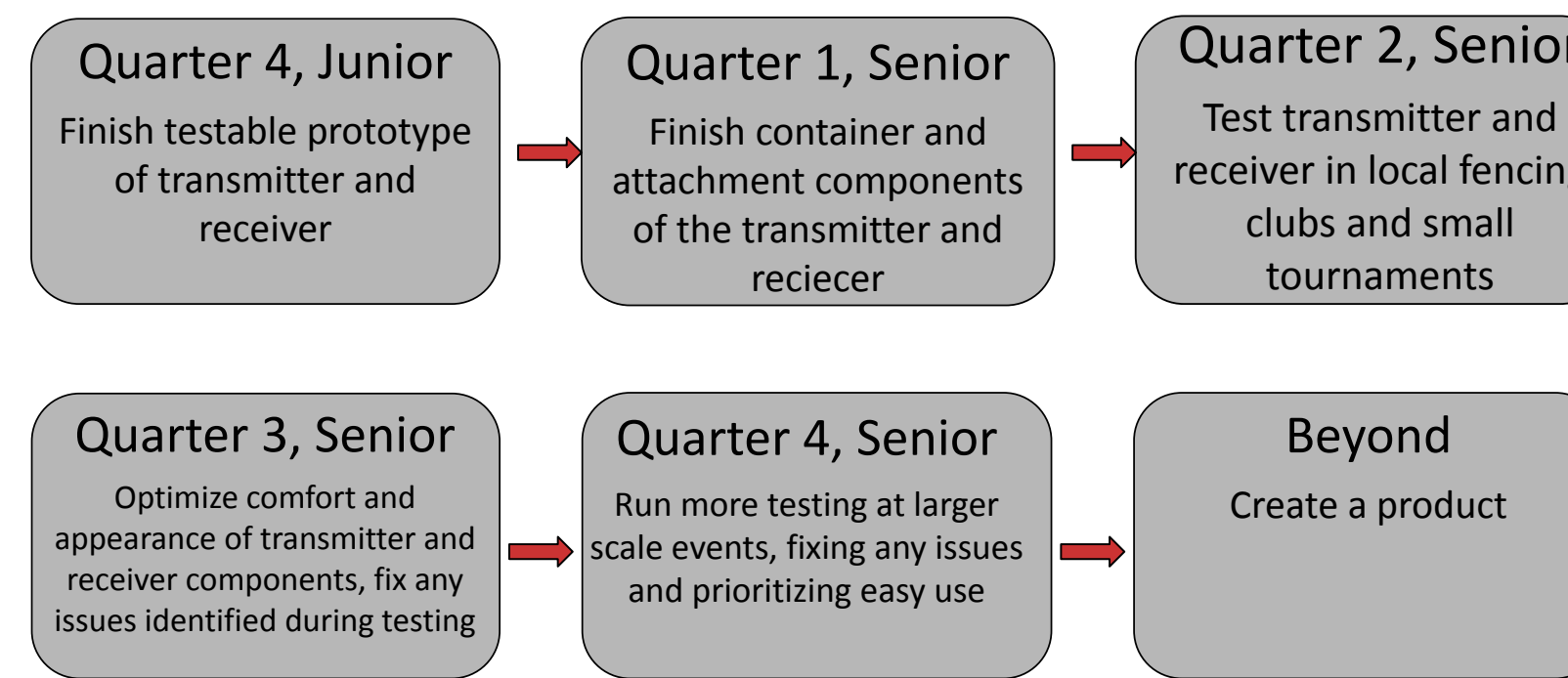


Fig 8 - Timeline

## Conclusion

This project aims to develop a compact, reliable wireless touch transmission system for épée fencing, eliminating the reel, body cord, and floor cable from the current scoring setup with as little alteration to the fencer's experience as possible. The system replaces these components with a small transmitter which attaches to the bell guard, communicating wirelessly with an identical receiver at the scoring machine

In senior year, the primary goal is to produce a fully testable and refined prototype that can be tested and used at fencing clubs and tournaments.

## References

- Mirzaei, B., Nezamabadi-pour, H., Raoof, A., & Derakhshani, R. (2023). Small Object Detection and Tracking: A Comprehensive Review. *Sensors*, 23(15), 6887. <https://doi.org/10.3390/s23156887>
- Edriss, S., Romagnoli, C., Caprioli, L., Zanela, A., Panichi, E., Campoli, F., Padua, E., Annino, G., & Bonaiuto, V. (2024). The Role of Emergent Technologies in the Dynamic and Kinematic Assessment of Human Movement in Sport and Clinical Applications. *Applied Sciences*, 14(3), 1012. <https://doi.org/10.3390/app14031012>

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