LED FOUL INDICATOR [Ongoing]

Background:

The Villanova Band has a basketball tradition where any time a foul on the opponent is whistled, the drummer does a tom roll and then we do a chant with the student section immediately after. However, I noticed that many times the drummers were unable to react to the whistle fast enough to where the chant came out smoothly. I found out that their view of the court was incredibly obstructed by the sideline seating, blocking nearly half the court from their position. We have since developed a system where any time the whistle blows, they turn to me and I either give a point or thumbs-up for them to do the roll, or shake my head indicating a different call on the floor. Though it has worked decently well, there is still the problem of me being on the opposite end of the section as the drum kit. This forces the drummer to take a few seconds to find me through a crowd of 50-60 people which has proven itself difficult several times.

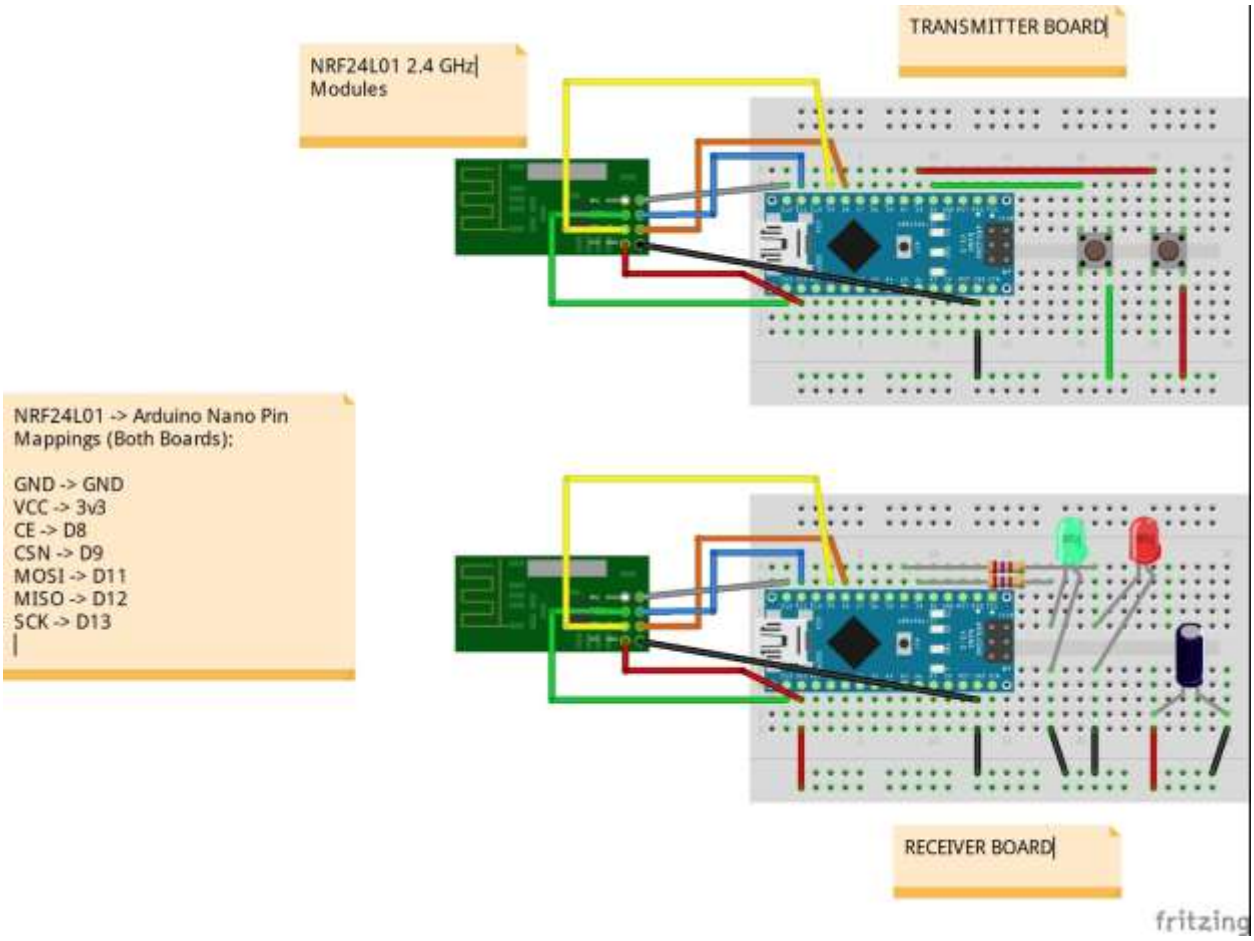
Thus I started this project with the goal of giving the drummers an easy and visible indicator for when to do the roll.

Scheme Description:

Though still ongoing, the general scheme is done pending a few tweaks. There are two small breadboards, both with Arduino Nano modules. The transceivers are NRF24L01 2.4 GHz modules, with the receiver having an antenna attachment (PA + LNA). As of right now, both boards are powered via the Arduino USB port, though this is planned to change to accommodate portability.

The transmitter board is a very simple button scheme containing both a red and green button. When pushed, the green button triggers the green LED on the receiver and leaves it active for 10 seconds. This gives some wiggle room in case the drummer doesn't immediately see the light as it is very easy to get caught up watching the game. The red button serves as a CANCEL/ABORT button and only stays active when the red button is pressed (momentary). This was added to the scheme after realizing some referees take a few seconds to make a call which ends up being different than what was anticipated (i.e. offensive foul or jump ball). It also serves as a test to make sure the board is responsive to the transmitter.

The receiver board contains two 270Ω resistors connected to each LED, with a 10 µf electrolytic capacitor between 3.3V and ground to serve as a small-scale voltage regulator.



Code Description:

The transmitter code involves sending a unique address to the receiver and following different functions based on the active states of the buttons. The internal resistors on the Arduino are declared as pullup resistors to correspond to the buttons active status. It is a simple and straightforward code, and so far has functioned exactly as planned.

The receiver code reads the address sent by the transmitter and then follows a very simple status reading code. Both the transmitter and receiver codes have serial print lines that served as a troubleshooting guide when writing it, as there were many instances of connection and functionality errors that have since been fixed.

Issues and Future Plans:

The boards have been tested many times with positive results. However, when implemented and tested at an actual game, there were several issues regarding power and connection. The biggest issue that I've been working through is the power supply. Since the boards are powered via USB, they needed a constant supply in order for the scheme to work as intended. The band section does not have a nearby outlet, so my next idea was to use a USB power bank. However, I discovered that since the amperage used by the boards are incredibly low, the power banks would automatically turn off after a short period, usually no more than 30 seconds, so this was also not a viable solution.

Right now we have the boards plugged into laptops which are able to provide a constant power supply but this is obviously not a great solution. I am currently working through wiring a battery pack to the breadboard through the VIN and GND pins, which would allow for maximum portability and secure constant power through a few AA batteries. The biggest obstacle with this is finding a way for the battery pack wires to sit snug in the pins and figuring out the best way to attach the battery pack to the board for portability purposes. I plan to 3D print an enclosure for both boards which will have the board and battery pack close together and leave the buttons, LED's, and transceiver modules exposed. This is the current phase of the project which should take a few weeks to work through ideas and 3D modeling.

Another underlying issue is getting a stable connection when the section is full of band members. We ran into a few issues with the LED's not going off, presumably due to the physical interference of band members and distance between the two boards as I am positioned about 20-30 feet away from the drum kit. Solutions for this are still up in the air. I plan to explore several options like using different transceiver modules, having fixed board positions that are physically above the band members, or even involving a third board to act as a signal jumper to decrease the distance between transmissions. My goal is to have the entire project complete by the end of January/early February which will be at the height of conference play and when we need to be on top of every call.