University of Central Florida

Remote Touchscreen-Controlled Defense Turret

Senior Design Documentation

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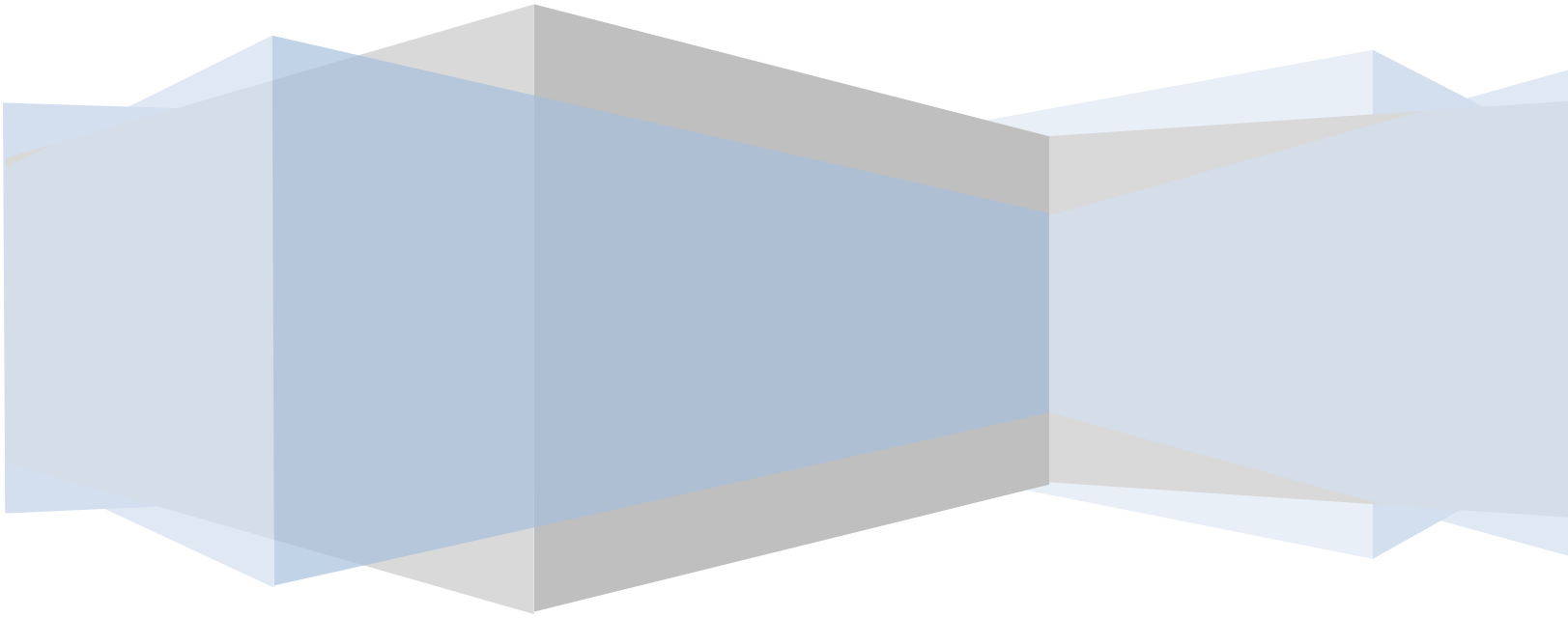


Fall 2011-Spring 2012

1 EXECUTIVE SUMMARY

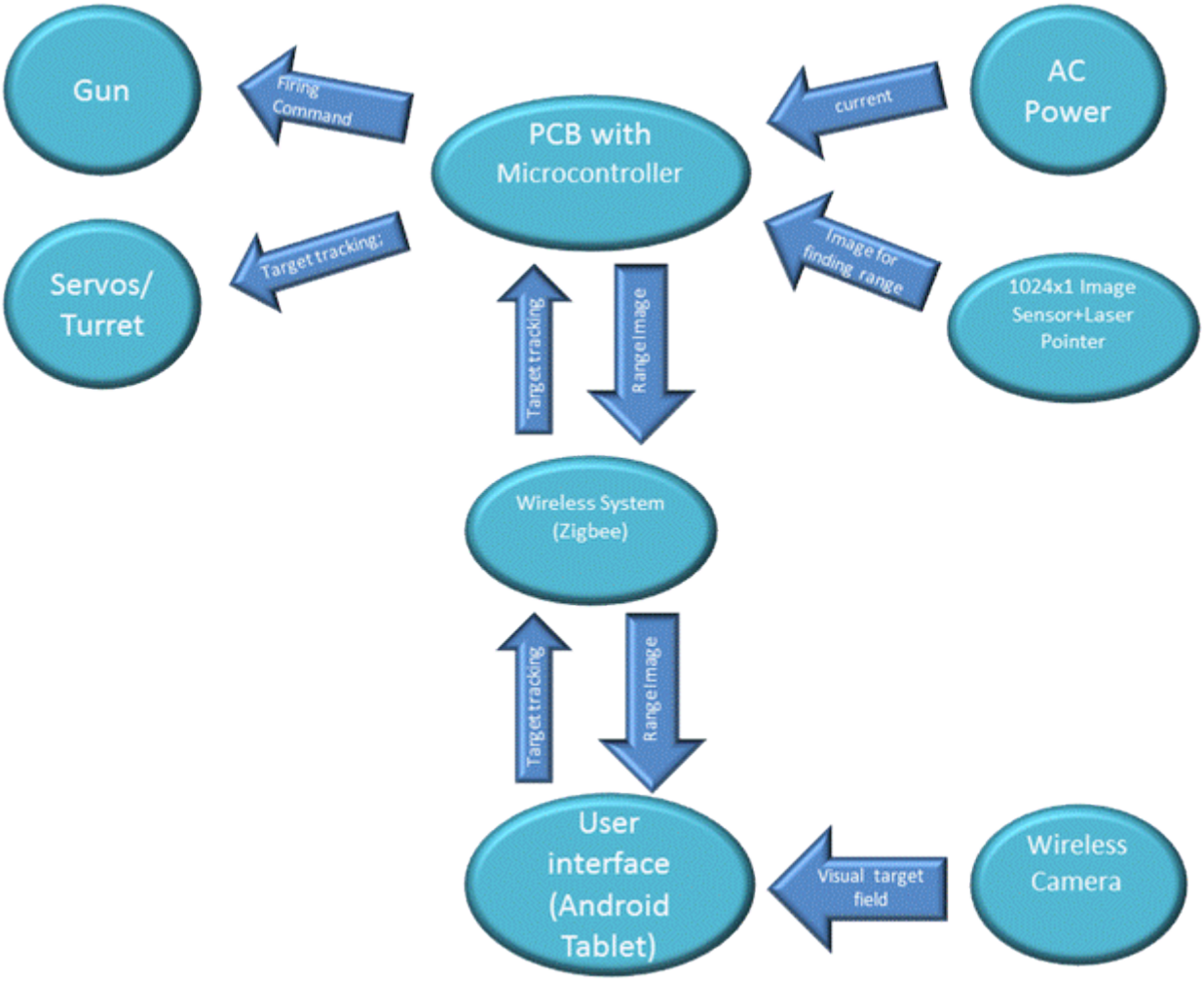
The remote defense turret is a platform for defending a sensitive area with human control, but without risk to the defender, or a need for such a defender to possess technical defensive skills. The turret monitors a field of defense with a wireless camera – to which it is physically attached – via wireless-n protocol, and automatically acquires any moving targets evident in this field. The targets are displayed to the user through an Open-CV-based user interface on a touch-screen tablet, which highlights the acquired targets via a color-coded outline. The user selects their target-of-choice – which will be tracked by the system as it moves, and updated constantly – by simply pressing the correspondingly-colored target button at the bottom of the screen. The system then calculates the centroid of the target, and relays the information to an Arduino microcontroller, at which point the Arduino controls the servo motors so as to appropriately point toward the target, and fires. In the prototype presented in Senior Design, the firing mechanism will simply be a laser, but attention was paid in hardware selection to allow for the firing device to be scaled up to a paintball gun, long-range taser, or potentially a traditional powder-bullet weapon, though this was not the group's primary concern; the system is designed to neutralize threats, rather than be an offense platform.

The simple nature of the user interface is intentionally made to not resemble tests of coordination such as those presented in first-person-shooter video games; the goal is a very "plug and play" type of interface that requires no training. However, completely defaulting aim to the control of the system leaves out the ability to fire upon stationary targets, or targets of greater choice than those which the system might automatically select based upon size and speed. Thus, an additional mode is available via the multi-touch feature of the user interface tablet: a desired target may be selected by the placement of the user's finger on the screen, and simultaneously pressing the manual fire button at the bottom of the screen, which is also indicated by a dedicated outline color.

To allow for the desired firing-mechanism scalability and interchangeability, the hardware of the turret was selected to over-perform in comparison to the lightweight laser-pointer in the prototype; it can readily be refitted with heavier devices. The digital servos are capable of traversing the entire field-of-fire in about a fifth of a second when un-loaded, and will slow down proportionally with heavier loads due to different firing devices. Fortunately, common servos from servocity.com were selected; thus, simple modular servo replacement - in the event that a retrofit of this system with a heavier firing device is desired – is easily accomplished.

The challenge of constructing the system lies not only in the control of the individual elements – OpenCV, the Arduino, and the User Interface, among others – but in at least equal proportion in coordinating these systems effectively.

HARDWARE BLOCK DIAGRAM



SOFTWARE BLOCK DIAGRAM