Autonomous Turret

Professor:

Dr. Samuel Richie

Sponsors:

None

Group 17: Members:

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Inspiration

The inspiration behind this project came from the fact that one of the group members is in the robotics club at UCF and two of the group members have been employed by the U.S. Government and the rest of the group has excellent programming backgrounds. The combination of all our information and knowledge into this Autonomous Robotic Turret will collectively challenge our Electrical and Computer Engineering capabilities. So from that we decided to do a type of turret that is self-operating, and that can defend an area to a certain degree, and that can also sense when there is a friendly in the area of fire of the turret.

Project Function

The function of this project would be to set up an Autonomous Defense Turret in an area and protect that area from hostiles or intruders. To do this we will have customizable web-camera and range finder input working along with a Laptop PC to do calculations and recording data. We will have a software implemented program that decides when to shoot, when not to, and compensation of metrics of the turret. In addition there will also be server support for aggregating engagement history and manual control of the connected turrets. The function of the project is highly depended on both Hardware and Software accuracy. The project will function as a simulation to a real defense turret and from our projects data and accuracy we will be able to calculate the error from our system. We will also have wireless control of an emergency cutoff system for safety purposes.

Goals

The goals of the Autonomous Turret are to provide a turret based weapons system capable of being operated based on its own judgment of its surroundings. The main goals of the system is motion targeting, color targeting, night vision, range finding, automatic fire rate, and a wide angle of vision that could be increased at a later date. The device should be able to recognize a low light situation to switch to night vision mode (should night-vision cameras be installed). We would like the system to be relatively low cost while maximizing functionality and customization. The system will be lightweight and customizable for satisfying a wide range of needs. The turret control software should run on user supplied Linux-based computer and handle its own power, and the turret based system should have its own operation power. A server will provide a relay station for accepting data from the turrets including engagement history/position and a live-feed, which will be available to a user at the server terminal. The server will also allow for manual override of the server in order to freely control the turret. We would also like the system to be open ended in the sense that there would be room for improvement, decreasing the percentage of error, and increasing the amount of accuracy.

Specifications and Requirements

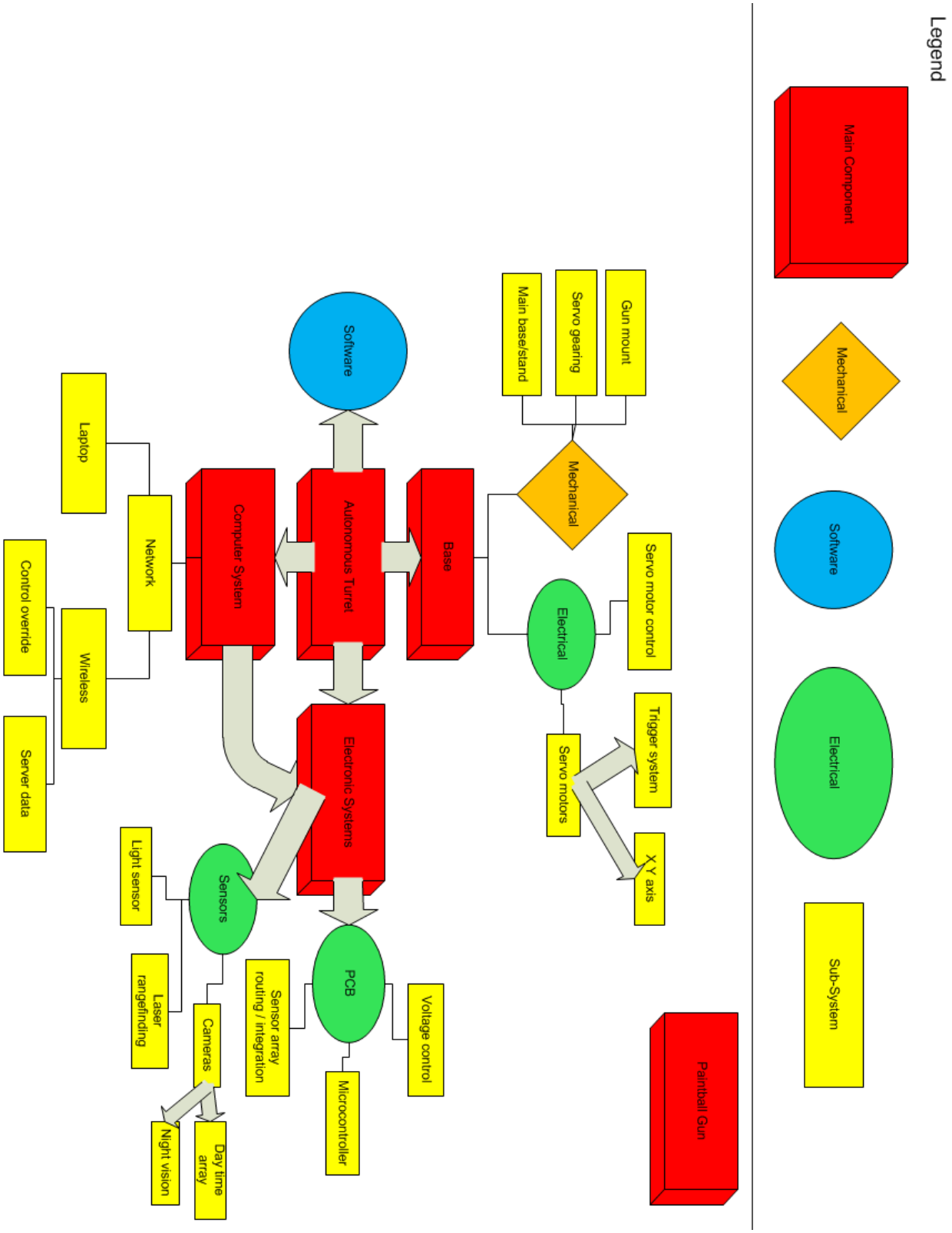
- The turret will run on a mixture of 12V and 24V DC input, from wall power or battery power.
- The turret base will be controlled by two servo motors, one for controlling pitch, and one for controlling yaw.
- The trigger for the turret will be controlled by a third servo motor.
- The turret will support firing from a paintball or airsoft gun.
- The system will identify the primary color of the target to determine the course of action.
- The turret will be support web-cameras for customizing and setting up the field of vision.

- The system will allow customizable perimeters for warning and firing up to the maximum range supported.
- The turret command server will support multiple turrets.
- The turret command server will provide real-time radar for the connected turrets.
- The turret command server will allow for manual control of turret with full control of the system including gun-mounted camera.
- The turret command server will keep track of engagement history and a snapshot of the targets.

- The battery life, when not connected to wall power, will be greater than 30 minutes in duration.
- The range detectable by the turret will have a maximum of 100 ft.
- Any targets within range will be given an audio warning and tracked. Targets within 50ft will be fired upon.
- The accuracy of the range finder capability will be within 0.25m.
- The response time of target acquisition/response will be less than 2 seconds.

- The delay in image processing will be less than 100ms.

Project Block Diagram- Hardware



Project Hardware Work Division:

Electronics and Hardware

- Nicholas Yielding
- Kyle Steighner

Nicholas Yielding Assignments:

- Electronic Systems
    - PCB design
        - Sensor array routing/integration
        - Microcontroller setup / programming
        - Voltage control systems
    - Sensors
        - Light sensor system design
        - Laser rangefinding system design
- Computer System
    - Wireless control override
- Base
    - Electrical
        - Servo motor control
    - Mechanical
        - Servo gearing

Kyle Steighner Assignments:

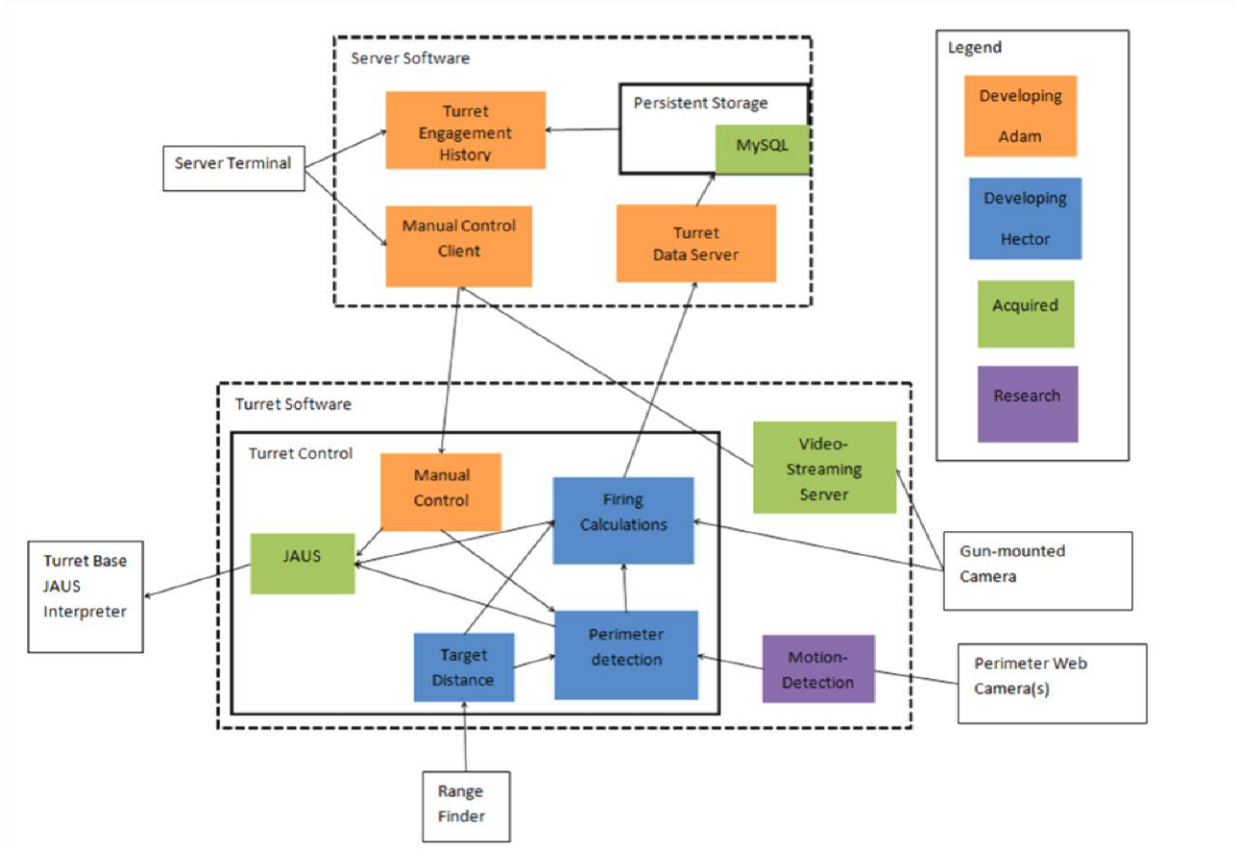
- Computer System
    - Network
    - Laptop
    - Wireless
        - Server data transfer
- Electronic Systems
    - Sensors
        - Cameras
            - Day time array
            - Night vision
- Base
    - Electrical
        - Servo motors
            - Trigger system

        - X Y axis motors
    - Mechanical
        - Main base / stand design
        - Gun mount design\

Status of Blocks

- Computer System
    - Network **DESIGN**
    - Laptop **AQUIRED**
    - Wireless **DESIGN**
    - Control override **DESIGN**
- Electronic Systems
    - PCB **DESIGN**
    - Sensors **DESIGN/TO BE AQUIRED**
- Base
    - Servo equipment **TO BE AQUIRED**
    - Servo controls **TO BE AQUIRED**
    - Base / stand **DESIGN**

Project Block Diagram – Software



Project Budget/Financing

Budget: $500 - Out of Pocket
Materials

- 1ft-100ft Distance Sensor - $120
- Servos - $150
- PCB - $60
- Base Materials - $100
- Offboard PC - (Already acquired)
- Onboard PC - (Already acquired)
- Paintball gun/Airsoft Rifle - (Already acquired)
- Webcams - (Already acquired)
- Night vision camera - $50

The cost of the project will be split evenly among the group members, unless at a later date it is decided that one group member wishes to take on the complete financing in order to keep the project for himself upon completion.