Draft Project Proposal

Due 6 February.

Prepare one proposal for your team's project and submit it via Gradescope. This will be graded. This is a tight deadline with high expectations; it will be difficult to submit a perfect assignment in time. However, you will have the opportunity to revise it after your meeting with Matthew Smith or Robert Dick. *Provided that you made a solid effort on your original submission*, a higher grade on the revised version will cancel a lower grade on the original submission. In the Approach section, specify which tasks will be complete by the first checkpoint (14 March) and the second checkpoint (4 April).

An example proposal follows. This is not an excellent proposal, and your final proposal (submitted on 13 February) should be much better. The purpose is to give you an understanding of the level of detail expected on 6 February.

Robot Laser Tag

Team: RoboLazer

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1 Customer

Perhaps game players, and remote control vehicle enthusiasts in particular. Maybe just us, as we didn't do customer discovery interviews to identify customers outside the team. We realize that this may limit the life of the project beyond the course and may reduce its usefullness and novelty.

2 Value

It is fun. It provides a more visceral, real gaming experience than you can get from a screen.

3 Approach

Our project is a robotic laser tag game in which there are two robots – one human controlled using a joystick and a second controlled by an artificial intelligence algorithm. The goal of the robots is to shoot at each other with infrared "lasers", playing a game of laser tag. A camera placed overhead tracks the location and direction of each bot.

Major functions of the project.

1. Object detection and artificial intelligence.
   (a) Desktop computer based preliminary object detection code for use in testing (Checkpoint 1).
   (b) FPGA-based object detection Verilog code functioning (Checkpoint 2).
   (c) Create software to translate high-level motion vectors to motor control signals, including using feedback from object detection to maneuver the robot to its correct position and angle (Checkpoint 1).
2. Wireless remote controlled robots.
   (a) Two robot chassis assempled with motors and H-bridges responding to commands from Nucleo board (Checkpoint 1).
   (b) Integrate controller on base station to remote control human controlled bot (Checkpoint 2).
3. Infrared "laser".
   (a) Use infrared receivers to detect a laser hit (Checkpoint 1).
   (b) Activate a light on the robot that is hit (using a single LED on each bot) (Checkpoint 1).
   (c) Activate a noise on the robot that is hit (using a buzzer) (Checkpoint 2).
4. Laser tag game simulation. Display the score (receive a point for hitting opponent) on an LCD display (Checkpoint 2).

4 Essential System Components

This is a high-risk project because basic functionality relies on numerous components. A lower-risk project would have basic functionality with few components, but improve with additional components. Your 17 February revision should indicate whether each component is in stock or must be ordered and identify sources for components. When practical, do so in the first version.

1. Inputs.
   (a) FPGA compatible camera (order).
   (b) N64 controller (stock).
   (c) 8 Infrared receivers (order).
   (d) 5 XBee, also used for output (stock).
2. Outputs.
   (a) Infrared LEDs (order).
   (b) 4 Motors (stock).

(c) 4 H-bridges (stock).
(d) 4 LEDs for when bot is hit (stock).
(e) Buzzer for when bot is hit (stock).
(f) LCD display for score (stock).

3. Other.
   (a) Three nucleo boards (stock).
   (b) Robot chassis (order).

5 Optional System Components

What additional components have the potential to improve the system's value?

1. Actuators causing the robots to topple on a hit (order).
2. Sophisticated learning AI implemented using FPGA (n.a.).

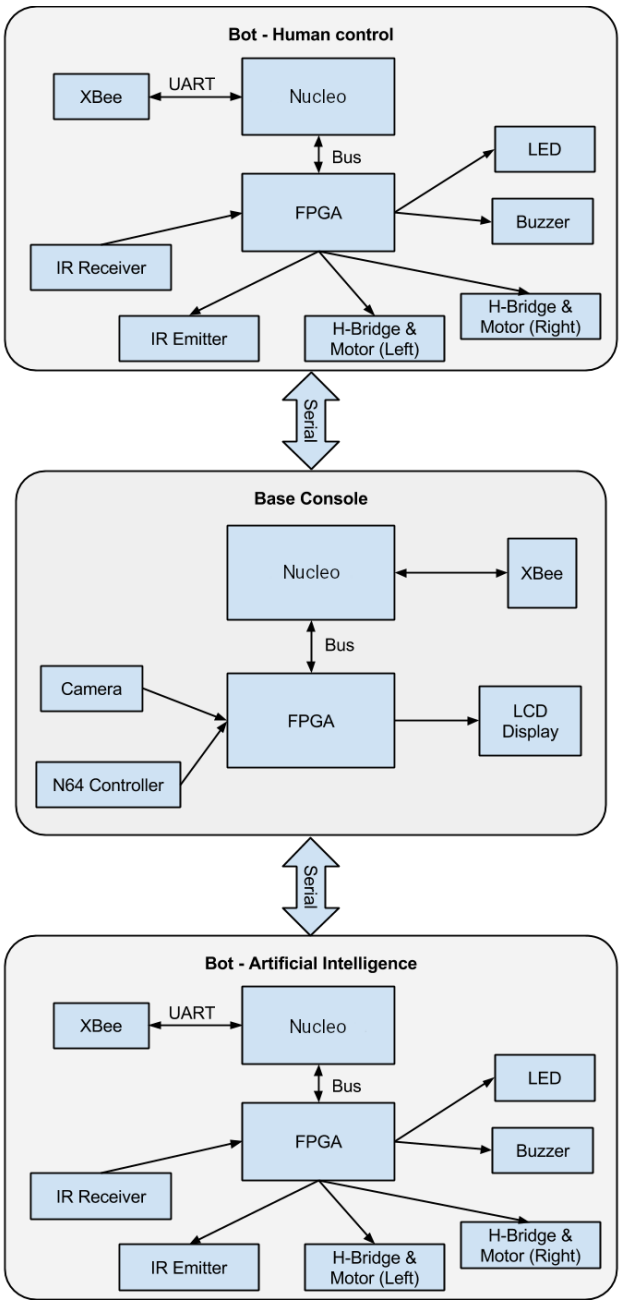

Figure 1: Functional diagram.

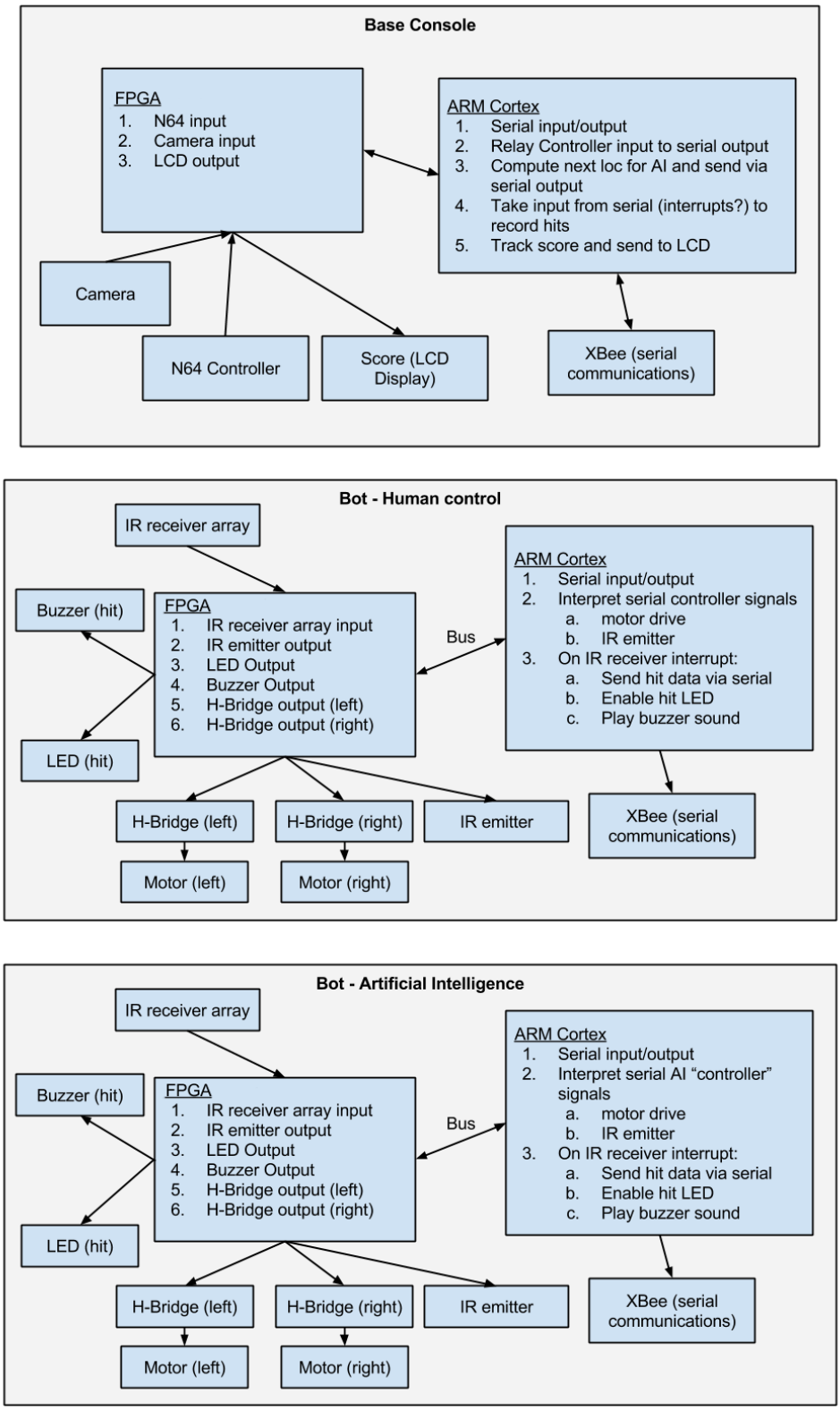

Figure 2: Component diagram.