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UCDenver CSCI 4287

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Requirements Specification

The LazerBoy Entertainment System:

Requirements Specification

Project Description - Background:

- Do you miss playing Duck Hunt? Are you sad your original copies of Area 51, Virtua Cop, and House of the Dead 2 don't work on your flatscreen television? Did your generation skip lightgun-based video games entirely?

Introducing:

The LazerBoy Entertainment System

Project Description - Summary:

- The LazerBoy Entertainment System is a game platform which allows players to shoot lasers at photosensitive targets and enjoy a variety of game modes.

Project Description - LazerGuns:

- LazerGuns are the controllers players use to interact with the LazerBoy Entertainment System. The LazerGun available at product launch will be the model M9B2. The LazerGun M9B2 consists of one 6 mm Class IIIa red laser, an Arduino Nano microcontroller, momentary switches for the trigger and slide, and an audio system for generating sounds related to the operation of the gun. The components will be integrated into children's toy non-projectile roleplaying guns which resemble United States Armed Forces standard issue Beretta M9 pistols. These toys are neither dangerous nor realistic, and they are not intended to cause fear or to assault another person (see: University of Colorado at Denver Student Code of Conduct §E.21). The Arduino Nano microcontroller will be connected to special circuitry designed to intercept the switches and interface with the audio controller components built into the children's toy (see: LazerGun M9B2 schematic on page 7 of this document). The microcontroller in each LazerGun M9B2 employs three outputs and two inputs and uses an input interrupt to enable an interrupt timer which manages switches and the duration of the laser pulse. Future LazerGun models may support different configurations and features. Physical appearance is subject to change.

Project Description - LazerTargets:

- LazerTargets are photosensitive devices designed to detect when a player has fired a LazerGun accurately and handle these events in the context of gameplay. Each LazerTarget consists of one or more arrays of photoresistors, a microcontroller, a speaker, a communications module, one or more status LEDs, one or more pushbutton switches and optional additional electronic circuitry. LazerTargets can function as independent modules for quick play, or they can be used in tandem with other LazerTargets for coordinated gaming for one or more players. Each LazerTarget employs at least three outputs and two inputs.

Project Description - The LazerDirector:

- The LazerDirector is a microcontroller which uses communication modules to coordinate interactions between the LazerGuns and the LazerTargets, depending on the game mode. It employs one input and one output for each LazerTarget active in the system as well as a configuration of user-interactive input and output components. At this time the LazerDirector is still in the conceptualization stage and might not be ready for product launch at the same time as the LazerGun and LazerTarget systems.

Requirements / States - LazerGun:

- The LazerGun will be powered on by inserting a USB battery into a compartment located inside the grip. Pulling back (i.e. “racking”) the slide at any time while powered on will cause the LazerGun to emit a racking slide sound and to switch the current state. A “cooldown”, “recharge”, or “reload” function which restricts the player from firing rapidly immediately after having already fired the LazerGun rapidly may or may not be implemented.

- ***Initial (Safety) State:*** The LazerGun will enter the Safety state as soon as it receives power. In this state, pulling the trigger will cause the LazerGun to only emit the racking slide sound.

- ***Semi-Automatic State:*** If the player racks the slide once within a predetermined duration, the LazerGun will enter the Semi-Automatic state. In this mode, pulling the trigger will cause the LazerGun to emit one laser pulse as well as emit a sound of the gun firing. This will not occur again until the player pulls the trigger again.

- ***Three-Round-Burst State:*** If the player racks the slide twice within a predetermined duration, the LazerGun will enter the Three-Round-Burst state. In this mode, pulling the trigger will cause the LazerGun to emit three laser pulses in succession as well as emit three sounds of the gun firing in succession. This will not occur again until the player pulls the trigger again.

- ***Fully-Automatic State:*** If the player racks the slide three times within a predetermined duration, the LazerGun will enter the Fully-Automatic state. In this mode, pulling the trigger will cause the LazerGun to emit a continuous succession of laser pulses as well as emit a continuous succession of sounds of the gun firing. This will occur for the entire duration during which the player holds down the trigger, and will cease when the player stops holding down the trigger.

Requirements / States - LazerTarget:

- A LazerTarget will be turned on as soon as it receives power. A red led on the target will light on to indicate that the target is powered on and ready to be used. In addition, the same push button switch will be used to switch between two modes: Independent and Active. If the player decides to switch into Independent mode, he/she will need to press the push button twice within a predetermined duration. In this case the status led will blink for a short duration. Timing and button event handling will be accomplished using timer and input interrupts.

- ***Initial (Discovery) State:*** Push button is pressed one time. Power led and status led are on and their colors are red and blue. LazerTarget will try to establish communication with the LazerDirector; it will send “READY’ signal to director and wait a predetermined duration for its response. If the response is received from the director in time, the target will be switched to Active mode. The color of status led will be changed to green. Otherwise, it will stay on blue, and the LazerTarget will switch to Independent mode.

- ***Active State:*** The color of status led is green. LazerTarget will receive direction from the LazerDirector. Direction will be dependent on the active game program. A typical game program will cause the the target to send a “HIT” signal to the director if a player fired a LazerGun and hit the target. The status led and speaker may indicate the successful shot. The LazerTarget will then wait for further direction from the LazerDirector.

- ***Independent State:*** The LazerTarget will enter the Independent State if the push button is pressed twice within a predetermined duration or communication between the LazerTarget and the LazerDirector was not established within a predetermined duration. The color of the status led is then blue. If the target is hit, the status led will start blinking and the speaker will indicate that a hit has occurred. When the push button on the target is pressed one time, the LazerTarget will switch to the Discovery State. Future LazerTarget models may support multiple gametypes in the Independent State.

Requirements / States - LazerDirector:

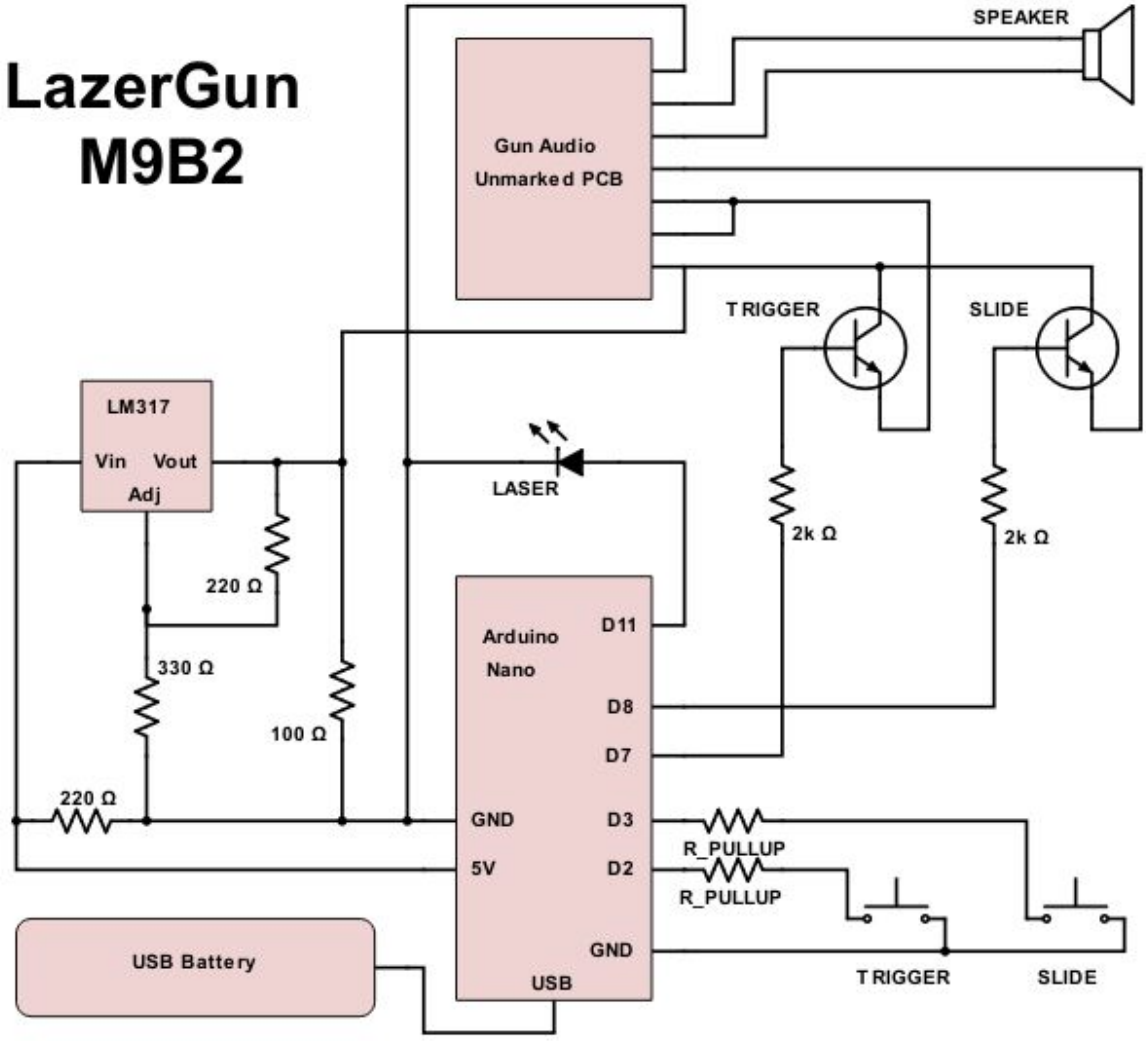
- The LazerDirector will turn on as soon as it receives power. Since the LazerDirector is still in the conceptualization stage, the final configuration of user-interactive input and output components and their ability to switch the LazerDirector's state has not yet been decided.

- ***Initial (Discovery) State:*** The LazerDirector will immediately begin scanning for available LazerTargets also in the Discovery State. If LazerTargets are found, the LazerDirector will enter the Selection State. If no targets are found, the director will remain in the Discovery State.

- ***Selection State:*** The player(s) will be permitted to select a gametype using user-interactive input and output components. Once a game has been selected, the LazerDirector will enter the Uplink State.

- ***Uplink State:*** The LazerDirector will establish communication with each participating LazerTarget which is in Active mode and upload all game parameters necessary to play the game successfully. Once all data has been sent to the targets, the LazerDirector will enter the Coordination State.

- ***Coordination State:*** The LazerDirector will now start the game. The director will coordinate all LazerTargets to provide a seamless gameplay experience. If a game ends normally, the LazerDirector will return to the Selection State.


LazerGun
M9B2
SPEAKER
Gun Audio
Unmarked PCB
TRIGGER
SLIDE
LM317
Vin
Vout
Adj
LASER
2k Ω
2k Ω
220 Ω
330 Ω
100 Ω
220 Ω
Arduino
Nano
D11
D8
D7
GND
D3
5V
D2
R_PULLUP
R_PULLUP
GND
USB
USB Battery
TRIGGER
SLIDE