**Idea 2: Battle Karts**

**Introduction**

Since the 1990’s, many millions of people who play video games have played a game from the Mario Kart series produced by Nintendo. The game pits up to 8 go-kart racers against each other to see who can finish the race first, with one caveat, each car can obtain randomly selected items placed around the racetrack that can help them win the race. The question we asked ourselves as a group was “How fun would it be to do this with real go-karts?” So, the main objective of this project is to produce a similar experience to the Mario Kart video game that would immerse the driver in a battle race that would require skill and a little bit of luck. The Overall design would be relatively inexpensive, could be applied to existing go-kart venues, and would try to capture the imaginations of those who have played the game along with those who haven’t.

**Overview**

The concept involves multiple go karts, a go kart racetrack, and the system on which the Battle Karts enhancement will exist. The Battle Karts system will be scalable, starting with a basic implementation that will allow a Kart to obtain an item by driving over an intelligent marker which is located on the track. Once driven over, a MCU on board the kart will randomly generate an item and display it for the driver. The item could be a laser cannon that shuts down other cars when hit, a turbo booster, a shield that protects one’s kart from lasers and a multitude of others. From there, the Battle Karts system can become more complex to allow for a rich, immersive experience that will add a new dimension to go kart racing.

**Specifications**

**Stage 1: Bare Minimum Components**

***Throttle Control*** : The throttle will be controlled by a server via an MCU using PWM. As well, some kart venues implement a drive by wire system, in which case our system could possibly tap into and override said system. Throttle can be increased or decreased with various power-ups on the track.

***IR Weaponry/Items*** *:*

*IR led “cannon”*:IR LED mounted on front and rear of kart, activated by item generator system, “fired” by trigger button located on steering wheel

*IR sensor:*  IR camera or sensor (possibly hack a Wiimote) located on front and rear of kart, vulnerable to IR cannon.

***RFID System***

RFID tags will be placed on certain areas of the track and could be highlighted or illuminated so as to be visible to the driver. RFID reader is located on the car connected to I/O on the MCU. RFID tags will represent the various weapons/items that can be obtained.

**Stage 2: Wireless Communication/Peripheral Enhancements**

***Wifi:*** a wifi shield can be created or obtained as a peripheral to the **MCU board**. The wifi shield would be low-power, and send information (via 802.11b/g/n) about the kart (position, target hits, lap count, lap time, etc) to a **server** that can update all other karts with the information.

***Xbee Mesh Network:*** An ad-hoc networking alternative to wifi that may be more suitable for this application. Cars would communicate with each other as well as a base station that could give racing results.

**In-Kart Display:** Depending on the capabilities of the MCU, an in-Kart display can allow the driver to see which item is currently available to use and for **track notifications**. A relatively small (5”) backlit LCD VGA display would be sufficient for a graphics-capable MCU, otherwise we would opt to design an array of 16-segment bi-color LED displays to visualize the items

**Upgraded RFID:**  Pole mounted or scaffolding mounted projector/motion sensor, “E-pass” style see picture

**Sound:** Mono or Stereo system. Track notification for accompanying item usage, plays track music, notifies driver of new laps.

**Integration: (Stage 1)**

-Basic driving

The kart(s) are all on, initialized, and at the starting line. When given the green “go” light, the driver of a kart will more than likely press all the way down on the throttle. The MCU throttle controller/servo system will limit the throttle to 80% of its maximum open position (so if the karts typically go 30 mph, they will be limited to 24 mph).

-Item sensing

The kart(s) will then approach segments of the track that have RFID tags secured to the track by duct tape and then visually enhanced so they can be visible (paint). A kart has to drive over the RFID tag so the RFID reader on the kart can tell the MCU that an item has been obtained. The kart will presumably be driving 24 mph (but could be driving 30+ mph explained later), so the RFID reader has to be responsive enough to capture the tag. The tagged Reader will send a signal to the MCU that will enable a function getItem() to run an algorithm that will randomly select from a series of kart enhancements(see below).

-Item Usage

The getItem() function will return an enumerated value that corresponds to the list of items. An item is deployed **by pressing a trigger button with the thumb located on the steering wheel**. Each item will have a different set of time limits, functions, and enhancements (there could possibly even be “bad”items). Items may include but are not limited to the following:

|  |  |  |  |
| --- | --- | --- | --- |
| Item | Effect | Duration | Probability |
| Front firing cannon (IR beam) | Stops a kart when sensor is hit | **3 rounds, indefinite** | **20%** |
| Rear firing cannon (IR beam) | Stops a kart when sensor is hit | **1 rounds, indefinite** | **30%** |
| “Star power” diff name? | Invincibility, 100% throttle | 7-10 seconds | 10% |
| “Lightning Bolt” | All other karts – 10% throttle | 5-7 seconds | 10% |
| Turbo Boost | 100% throttle | 2-3 seconds | 30% |

For the purposes of stage 1, the driver will know which item they have by looking at an LED display located safely above the steering wheel or a nearby location. Perhaps a getItem() function in the game code will be returning a value for a display function that has programmed messages and symbols that correspond to the item at hand. The LED array will consist of (8) 16 segment displays that will receive the proper message via serial communication. The display will remain lit for the given duration of the item’s effects.

-Sensors

The way the laser cannon item works is similar to a basic laser tag game. An IR LED and an IR sensor will be located on the front and rear of the kart. If a driver accurately hits the IR sensor area, the targeted kart’s sensor will send a signal to the MCU to tell the PWM throttle control to cut off for a duration of 3seconds, which will allow the shooting kart the opportunity to pass the targeted kart, however, revenge is sweet!

Stage 2 integration will be handled on a time sensitive basis.

**Spring 2013 Milestones**

|  |  |
| --- | --- |
| Date | Goals |
| Feb. 8 | Have a sponsor, or a plan to obtain go- karts |
| Feb. 22 | Research PWM Throttle Control (TC) |
| March 1 | Have a model of TC complete.  Research RFID. |
| March 15 | Research various MCU candidates, understand RFID integration with MCU |
| March 29 | Research IR/sensor implementations, design and incorporate with MCU, know how to solder, know CAD tools |
| April 12 | Rough draft of research paper complete |
| April 24 | Finalize research paper |

*\*Summer2013: begin prototyping, research x-bee and design for possible inclusion in project*

**Fall 2013 Milestones**

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| --- | --- |
| Date | Goals |
| Week 2 | Working prototype of TC subsystem and power |
| Week 4 | Working prototype of RFID and laser sensor subsystems |
| Week 6 | Complete CAD board design, order plenty of boards |
| Week 8 | Program/flash MCU on devBoard, solder first board and incorporate into kart, Test and calibrate |
| Week 10 | Solder other boards and complete remaining Karts to spec of first working kart system |
| Week 12 | If goals met, implement selected elements of stage 2 |
| Week 14 | Set up an on or off campus track and video a demonstration of the system in action |
| Week 16 | Presentation |