SUPER TANK BLITZ

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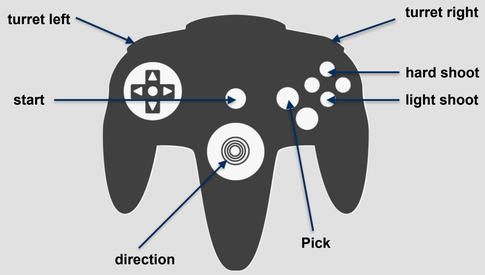
Project Introduction

As computer technology constantly making progress, video games have become more and more realistic. Although the technology gets advanced, it is not possible to simulate all the games in PC. In this project, we design and implement a non-trivial game system called Super Tank Fun. Two users control their real tanks using N64 controllers, and they should try to beat the enemy by shooting at the opponent tank.

Fig 1. Inspiration for the project

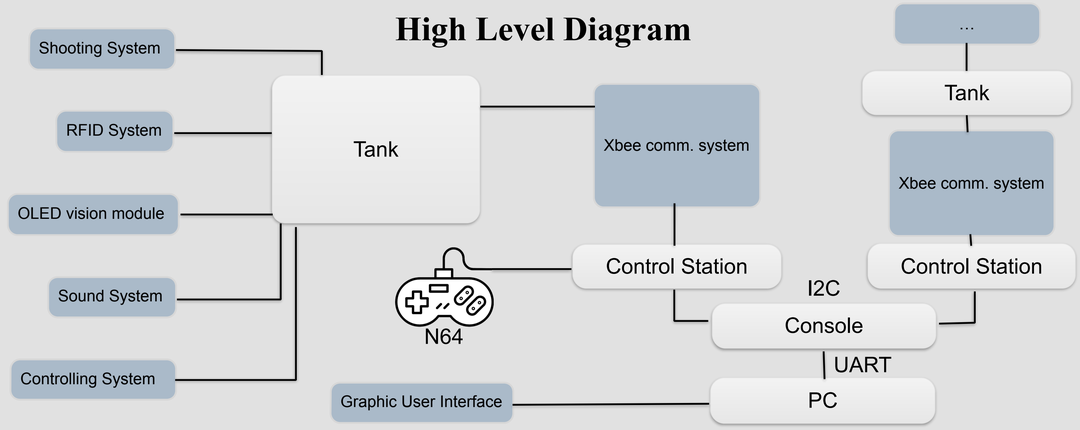
Control



Game Rule

1. Player mush push start when game begins
2. Every Tank has 1600 HP when start up
3. One player wins when HP of the opponent's tank drop to or below zero
4. A tank could do light shoot every 2 seconds
5. A tank could do hard shoot every 30 seconds
6. A tank could pick up an item every 30 seconds.
7. HP decreases by a value between 150 ~ 250 when hit lightly. Hard hit doubles the damage.

High Level Diagram



Peripherals

1. Xbee

The wireless communication between tank and N64 controller is implemented using Xbee (802.15.4) series 1 module. Xbee interacts with smartfusion using UART serial bus. All the Xbee modules are communicating in API 1 mode, and each communication packet is either 14 bytes or 15 bytes including the meta data.

Fig 2. Protocol of wireless communication

2. N64 controller

User controls the tank using N64 controller. The smartfusion board sends a request byte (0x01) every 10ms to the controller, and the controller sends back a 32 bits signal. Smartfusion board parses the 32 bits signal using Manchester encoder, Manchester decoder and super sampling technique.

3. RFID module and RFID tag

Each tank has an RFID RC522 module mounted on the bottom of the tank. The RFID module interacts with smartfusion using SPI serial bus and the module operates at 13.56 MHz. Each tag has different built-in ID, and they are used to indicate different items.

4. IR Led and IR Sensor

The turret is simulated using IR Led. The IR sensors are used to detect the shooting signal. The IR sensors demodulate IR signals at 38 kHz. To avoid the tank shooting itself and implement different shooting effect, we design a protocol in the IR signal to indicate the ID of the tank and the type of shooting effect.

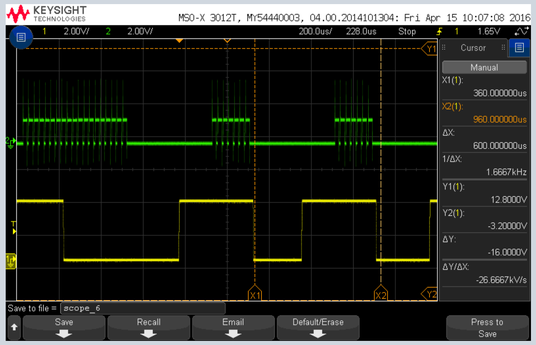


Fig 3. IR Subsystem Protocol

5. Audio Module and Speaker

Each tanks has a WTV020-SD audio module mounted on its PCB. The audio module is used with a 2GB SD card, and the sound system is designed using bit banging design pattern. The audio module operates on two line serial mode.

6. OLED

Each tank has an OLED soldered on the top of the tank. The OLED is used for debugging purpose as well as demonstrating the tank information. The OLED interacts with smartfusion using I2C serial bus, and all the graphic interfaces are implemented in C.

Hardware and Software

1. PCB design

In order to make the whole project elegant, we design our own PCB using Eagle software. All the components in the PCB are soldered using through hole soldering technology.

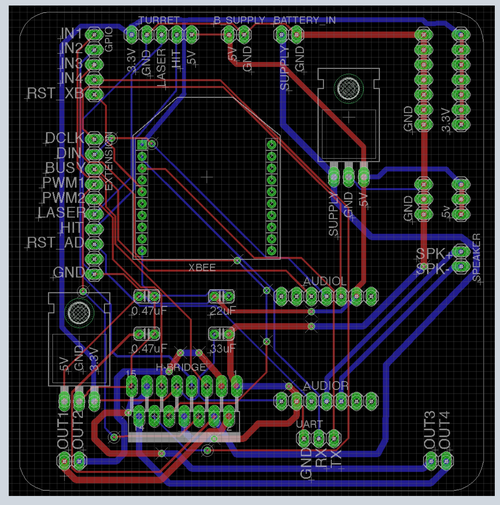


Fig 4. PCB Layout

2. Flow Control

APB bus is used to communicate between micro-controller and peripherals. The system has different interrupt sources to notify the microprocessor. The interrupt handlers react to all the external events. In order to have enough timers to trigger all the real time events, the system has a virtual timer implemented in linked list. The system also has a GUI implemented in Python, Tkinter and OpenCV.

Conclusion

In order to improve the user experience, the N64 controller could be replaced with a wireless controller (PS2 or gamecube). The wire connection could be simplified further by designing a shield PCB mounting on the smartfusion. Finally, We would hereby thank Dr.Brehob, Mr. Smith, Instructional Aides of this class as well as EECS Department for their generous and immense assistance and advice in our project implementation.