

# EE 3710 – Embedded Systems

## Semester Project – Gorilla

---

### Introduction

In 1991, Microsoft released MS-DOS 5, an operating system that included a BASIC language interpreter, QBasic. To demonstrate the power and versatility of QBasic, Microsoft also included a video game called Gorilla. In this game, two opposing gorillas stand on a city skyline and take turns lobbing explosive bananas at each other until one is destroyed. Players must cope with a different skyline and wind speed each time the game is played.



Figure 1. Gorilla

For this project, we use the LCD to display the skyline, gorillas and bananas. Two knobs are used to set the launch speed and angle of the bananas. A push button is used to launch the bananas, and a speaker is used to generate a sound when each banana is launched and when it explodes. Game parameters are configured using a DIP switch.

### Design.

Any product such as GORILLA will have hardware, software and mechanical designs. You will need only to document the (electrical) hardware and software designs, but be aware that there are circuit boards that need to be laid out, plastics to mold, connectors to fit, etc. All these things are covered by the mechanical design but are beyond the scope of this class.

Often, engineers buy a development kit such as the C8051F020DK to build a prototype so that hardware can be tested before it is rendered to a circuit board and so that software can be written while the physical parts are in fabrication. The development kit itself is not part of the design, but designers borrow liberally

from it for their designs. For example, an engineer may use the power supply from the evaluation board for his design. See Figure 2.

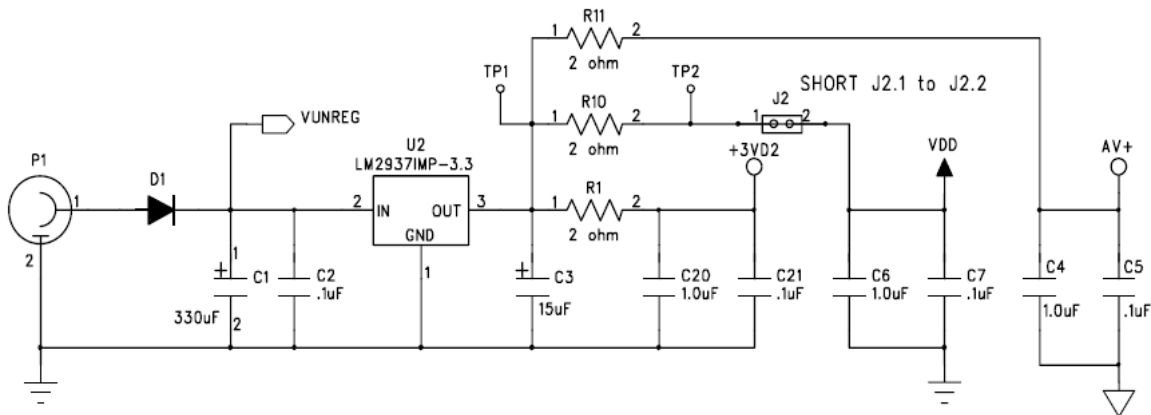


Figure 2. Power Supply from the C8051F020DK

Your design will need to include the power supply, crystal oscillator, reset circuit, etc. You can get that part of the design from the development kit schematic (don't just copy the images, use a schematic capture program and incorporate the parts you need). You won't need, for example, the serial port or any of the LEDs, so you should not include those parts in your design.

You will need to document your design using the guidelines on the course website. Remember, the design document describes the design of the finished product, not the evaluation kit and not the experiences you had while developing it. Be as clear, complete and concise as possible, and remember that your audience consists of engineers with similar technical background to your own.

The project must be passed off during the last lab section of the semester. Design documents are due at the time of the Final Exam.

## Requirements.

1. The system shall run on an external 9v DC supply.
2. The system shall use a 64x128 pixel LCD to display the skyline, gorillas, wind speed indicator, launch speed indicator and launch angle indicator.
3. The system shall have two buttons. One reset button and one launch button.
4. The system shall have two potentiometers located near the LCD that can be used to adjust banana launch speed and angle.
5. The system shall have two dip switches to adjust difficulty, one for each player. If a player's switch is off, the wind speed shall be set to zero when he launches his banana.
6. Upon reset, the system shall display the words "Ready" and "Press Launch Button to Start" in the center of the LCD display. The skyline and gorillas may be displayed in the background but it is not required.

7. When the launch button is pressed initially, the system will randomly select and display (a) the skyline, (b) the wind speed and (c) the gorilla positions.
8. Player 1 shall always play the leftmost gorilla and shall have the first turn. The rightmost gorilla is played by player2. The system shall indicate whose turn it is.
9. A turn shall consist of a player (a) adjusting launch speed and angle using the knobs, and (b) pressing the launch button. At this point, the system shall animate a banana launched from one gorilla that follows a trajectory consistent with requirement 10. The turn ends when the banana (a) strikes a building in the skyline and explodes, (b) strikes either gorilla and explodes, or (c) traverses the left or right boundary of the LCD display.
10. The velocity of the banana shall be  $V_x = V_{x0} + Wt$ ,  $V_y = V_{y0} - gt$  where  $(V_{x0}, V_{y0})$  is the initial velocity,  $w$  is proportional to the wind speed, and  $g$  is constant. If the banana goes off the top of the LCD display, the system shall continue to compute its trajectory but will not display it until its position is once again within the bounds of the LCD display.
11. The launch speed and angle must be accurately indicated on the LCD display while adjustment are being made.
12. The system shall generate a sound when a banana is launched and a different sound when the banana explodes.
13. When a banana hits either gorilla, the game is over, and "Game Over" and "Press Launch Button to Start" shall be displayed in the middle of the LCD display. The remaining gorilla and skyline may be displayed in the background, but it is not required. The system will remain in this state until the launch button is pressed, at which point a new game begins with a random skyline, wind speed and gorilla position.
14. When a banana hits the skyline and explodes, it may either erode the skyline or leave it unchanged.