

Design of Embedded Systems, Advanced Course
EDA385

Project Proposal

Daniel Lehtonen, dt08dl4
Emil Selinder, dt08es7
Fredrik Johnsson, dt08fj8



LUNDS UNIVERSITET
Lunds Tekniska Högskola

1 Introduction

The goal with this project is to construct a game running on an FPGA, taking input via a keyboard connected to the PS/2 port. The results (the game) will be shown on a monitor connected to our VGA port. The project will be implemented partly in software and partly in hardware, where as the hardware will include controllers for the keyboard and the monitor as well as a CPU and some kind of graphical unit.

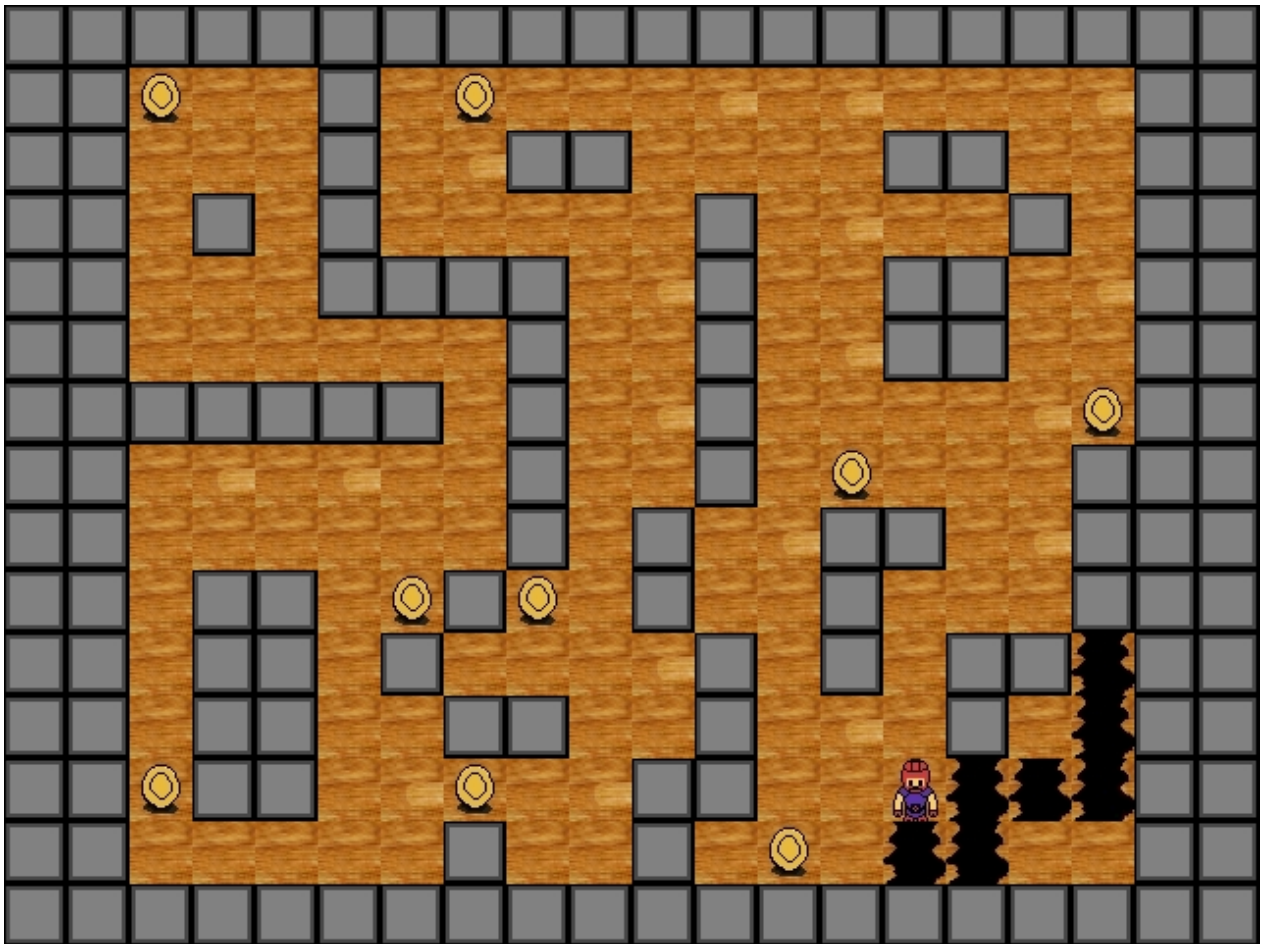


Figure 1: A concept image of how the game could look.

2 Gameplay

The idea of the game is to control a character searching for riches. There will be pennies scattered around the map and collecting all the pennies is required to complete the game. The challenge is that you need to be quick because once you step on a tile you can only stand on it for a short period of time before it breaks and you fall with it. Once you leave a tile you can never return to it since it will break after being used once, therefore you must be quick and choose a path that will give you all the coins. A typical map of the game is shown in Figure 1.

3 Description

The general idea of how the system will be designed is shown in Figure 2.

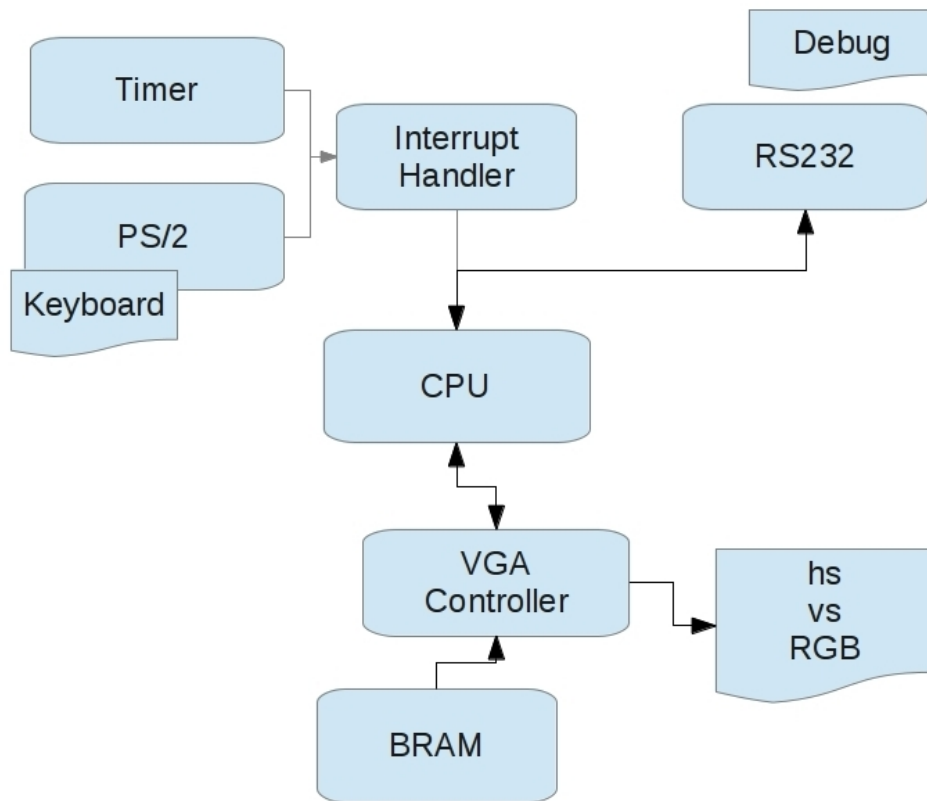


Figure 2: Block diagram of the system.

3.1 Graphics and VGA-Output

The game will have a resolution of 640 x 480 pixels @60Hz and we have chosen to build the map using a few 32x32 pixel picture frames reducing the need for a lot of memory. These frames will be stored on the BRAM and we will use these frames repeatedly to build the map.. This will result in giving us a grid of 20 x 15 frames where the actual maze will be built, giving us a rather decent possibility of creating several maps (if the schedule allows us).

3.2 Inputs

To control the game a USB or PS/2 connected keyboard will be used and the decoder will be created in VHDL. This decoder will send interrupts to an interrupt handler so the game logic can be notified of a key stroke. Only four buttons will be needed, one for each direction and when a key is pressed the character will move one tile in that direction.

A timer will handle the timeout for each visited floor tile and send an interrupt when time is up. When the character leaves a tile, the timer is reset and bound to the new tile. If the player is on a tile that times out the player will fall down the hole and the game is over.

During implementation there will also be input from the USB-UART bridge (RS232) used as debugging.

3.3 Processor

Our system will be based on a single MicroBlaze processor with hardware accelerators for

graphics and I/O.

3.4 Memory

The game logic won't require much memory but the graphics will. But because of the picture optimization we hope that it will be enough to have a BRAM to store the graphics data.

3.5 Software

The game logic will be written in C and runs on the MicroBlaze processor. The game logic will keep track on the game board which involves; on what tile the character are, where the pennies are, what tiles are walls or holes. It will also decide the structure of pictures that will be waiting on the BRAM for the VGA-controller to send to the display. It will also decide where the character should move depending on the input from the keyboard. Apart from this it will also keep track of how many pennies that are collected and whether the game is ongoing or the player has won or lost the game. Since the game only uses five different objects, the map will be represented by using a 20x15 sized matrix containing a value that is mapped to the content in each element in the matrix. When the character moves in the world, software logic will check the conditions for the move and based on the result the content in the matrix will change for the concerned elements.

5 Time Plan

To make sure the project will be finished in time and to manage the group a time plan has been made, describing the different tasks, when they will be implemented and by who.

Week 1	- Decide on Project (All) - Project Proposal (All) - Make Graphics (Daniel)
Week 2	- Hand in final project proposal (All) - Present proposal (Fredrik) - Complete Graphics (Daniel) - Start with Keyboard Controller and VGA Controller (All)
Week 3	- Continue with Controllers (Fredrik and Emil) - Make Game Logic (Daniel and Emil) - Testing (All)
Week 4	- Complete Keyboard Controller (Fredrik and Emil) - Complete Game Logic (Daniel) - Continue with VGA Controller and Hardware (Fredrik and Emil) - Test Keyboard Controller and Game Logic (Daniel and Fredrik)
Week 5	- Complete VGA Controller (Fredrik and Emil) - General Testing (Fredrik and Emil) - Start with Report (Daniel)
Week 6	- Final Testing (All) - Finish Report (All)
Week 7	- Finish Report (All) - Demonstration (All) - Presentation (Emil and Daniel)
Week 8	- Final Report Deadline!