

Module 1 High Level Design

1. Hardware architecture of the system

NIOS II/f

- SDRAM Controller: Given that our code will consist of many complex libraries we expect it to be too large to fit on the onboard memory, instead we will offload it to the SDRam
- We might want to drop to NIOS II/s if the FPGA cannot fit all the hardware

Hardware Accelerated Pallet Swapper:

- Since the screen is limited to 64 colours, we will program it with the 64 colours in the 6-bit RGB space. As such whenever we receive an image from the camera, we will run it through a hardware accelerated pallet swapper switch the 16 bit RGB values of the image's bitmap to 6 bit RGB

Hardware Accelerated Fill Algorithm:

- Once we draw the button boundaries in software, we will implement a hardware accelerated fill algorithm to fill in the button

LCD Display (on touchscreen)

- To display the gui to the user

Speakers:

- To play the sound outputted by the audio codec

Audio Player Hardware

- Play sound effects when on screen elements are pressed
- Sound effects are stored as uncompressed audio data on DRAM

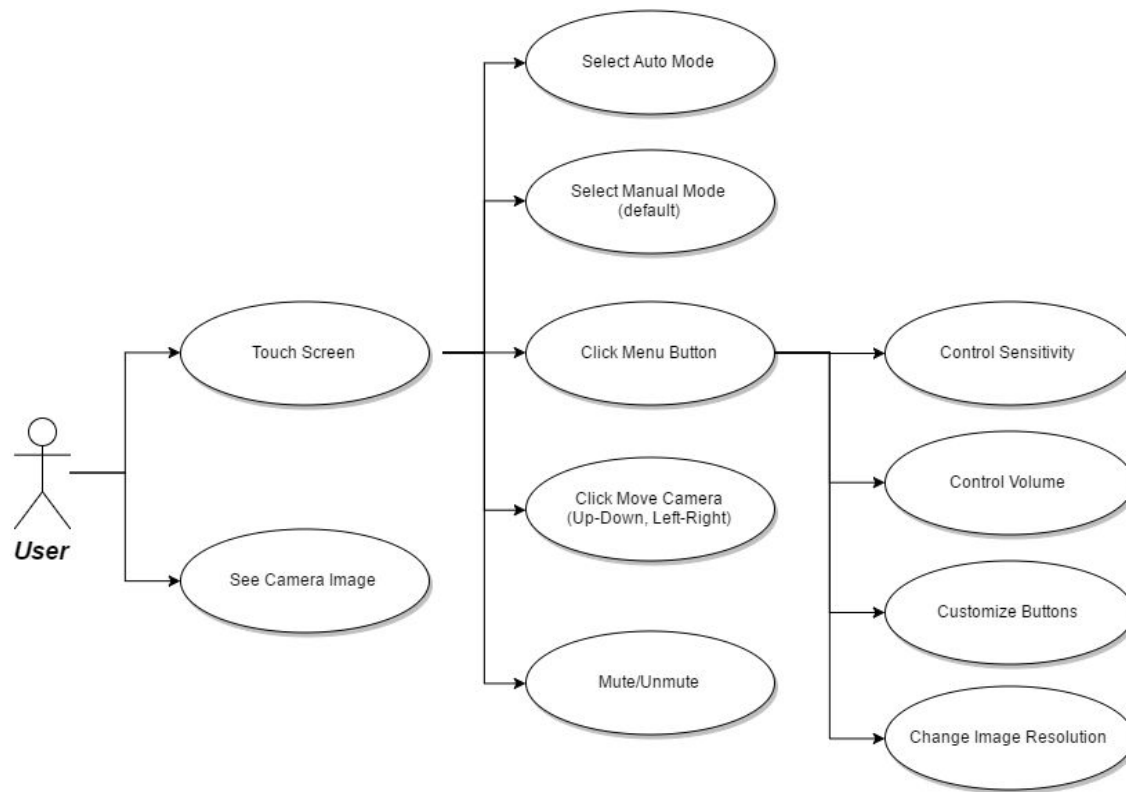
3 Parallel Ports

- 2 stepper motors to move the camera up-down left-right
- 1 servo motor to fire a projectile

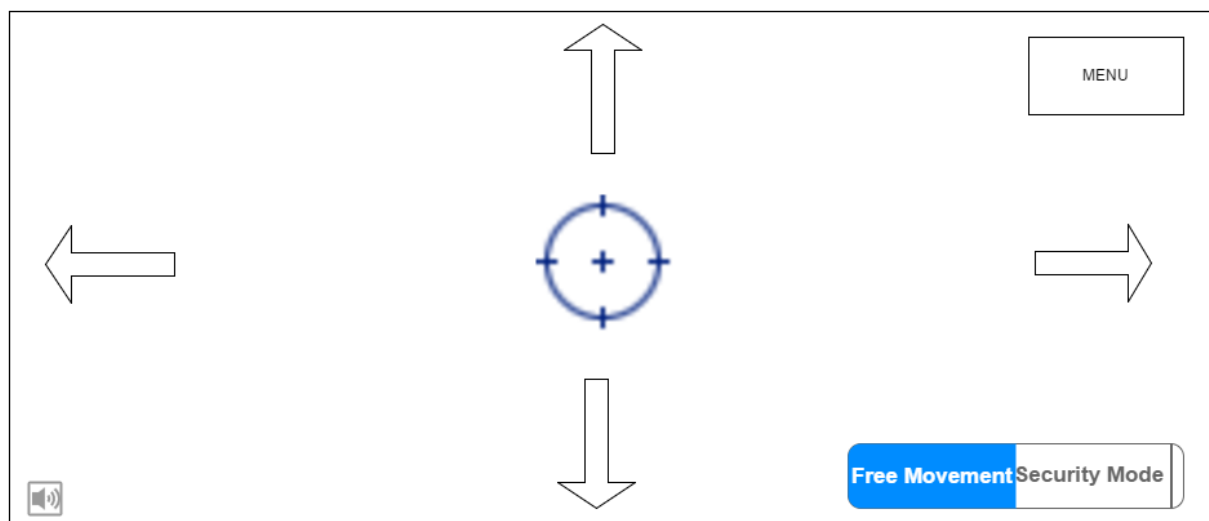
3 Serial Ports

- Touch screen receive user input
- Camera to provide the image that will be shown on the display
- Wifi Dongle to upload the taken images to a server

2. Software functionality

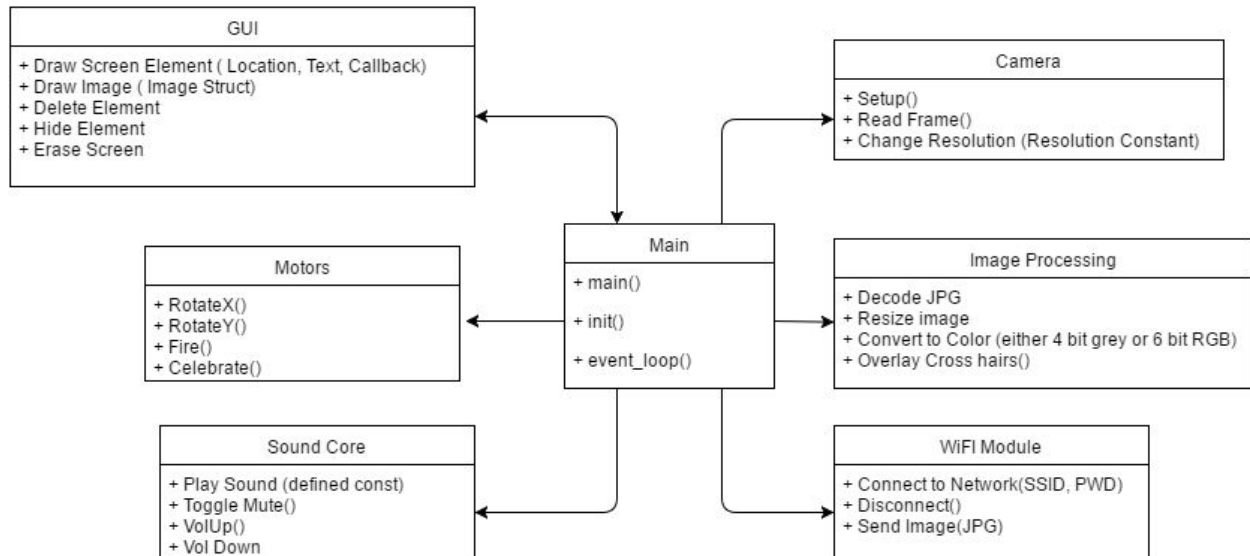


3. Graphical User Interface



4. High Level Software Design

The software that will run on the DE1 SOC can be modeled as a main program that utilises a set of libraries to accomplish its tasks. The following libraries are the main and important ones we can think of:



5. Major Data Structures

- Colour palette (on-chip) - const static array of 64 values representing a colour each
- Frame (off-chip) - 2D bitmap array (640x480 each position is a pixel), each value = index of the colour palette (0-63)
- JPG image (off-chip) - array of bytes
- Screen element (off-chip) - struct containing disable flag, extents (top left, bottom right)