



JAVAGEAR

www.javagear.co.uk

PROJECT SPECIFICATION 1.0

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Introduction

Emulation allows software written for one computer to be executed on a different computer, with identical results. An emulator is the name of the piece of software and/or hardware that is required to achieve this.



This project aims to emulate the necessary hardware to run software originally written for the Sega Master System and Sega Game Gear consoles. This includes a huge range of successful titles, including the Sonic the Hedgehog series (pictured left). Despite physical differences, the Master System and Game Gear are internally similar machines, which means emulating both of them simultaneously is a viable proposition.

JavaGear, as its name suggests, will be a software emulator written in Java. It will run as a standalone application, and as an applet on a web page. JavaGear will include emulation of the Z80 CPU, custom video controller, SN76489 sound chip, memory paging registers and the controllers or joysticks. This is to say that JavaGear aims to fully emulate the two systems.

JavaGear will not only provide accurate emulation, but will also offer additional functionality that the hardware doesn't provide. The casual gamer will appreciate the improved multiplayer gaming capabilities, allowing them to play against anyone online, as opposed to those sitting with them in the same room. For power users, the debugging facilities offered by JavaGear will be a useful way to examine game code and graphics. Overall, JavaGear has the potential to render the original hardware obsolete, and make hundreds of software titles accessible to a new user base. To do this it must be fast and accurate, whilst retaining the simplicity of the original hardware that made it so popular.

Similar Projects

There are currently no other Master System or Game Gear emulators for Java. There are, however, around 15 other Master System and Game Gear emulators for different platforms. I'll look at the best of them here:

- **Meka** - <http://www.smspower.org/meka/>

This is an excellent emulator, offering high compatibility and a great interface. It even allows you to build a hardware interface, so that you can plug in original Sega peripherals like 3D glasses. Unfortunately, it's only available for DOS and Windows, and as it's shareware, you need to pay for the software if you decide to use it regularly.

- **SMS Plus** - <http://cgfm2.emuviews.com>

Unlike Meka, this emulator is free and open source. The user interface is not as sophisticated as Meka's. This is in order to keep the code portable, meaning the interface code is left to the authors managing the individual ports. Writing JavaGear in Java will overcome these platform limitations, as all platforms will share a common interface.

There are already a range of emulators, written in Java, for other console formats. The most popular are detailed below:

- **JavaBoy** - <http://www.millstone.demon.co.uk/download/javaboy/>

This is a GameBoy emulator, and boasts a high compatibility rate of 95%. It also offers TCP/IP based game link support, although this currently only works on three titles. Unfortunately, there is no sound emulation at present.

- **GameBoy Emu**

<http://www.javaprogramming.co.uk/applets/GameBoyEmu/GameBoyEmu.html>

This is a GameBoy emulator programmed by a former Birmingham student. It has a great interface, but again there is no sound, there are graphical bugs and compatibility is comparatively low at 70%.

- **NesCafe** - <http://www.davos.co.uk/>

This is a NES emulator, complete with sound, excellent compatibility and support for additional peripherals. It's the best emulator I've seen that has been written in Java.

Feasibility Study

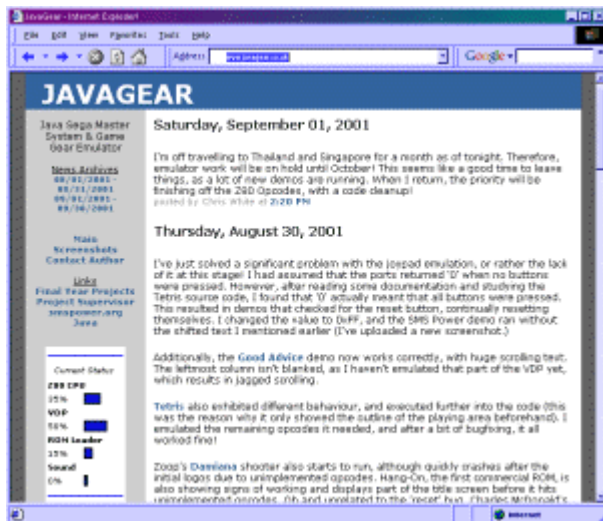
Software Requirements

- **Java SDK 1.3** - <http://java.sun.com>
Compiler, APIs and Java Virtual Machine.
Available on home machine (Linux / Windows 98) and school machines (SunOS)
- **Xemacs** - <http://www.gnu.org>
Development environment for Linux / SunOS.
Available on home machine (Linux) and school machines.
- **Textpad** - <http://www.textpad.com>
Development environment for Windows.
Available on home machine.
- **Microsoft Word** - <http://www.microsoft.com>
Word Processor to create documentation.
Available on home machine.
- **Jaws PDF Creator** - <http://www.jawssystems.com>
Create PDF documents for cross platform readability.
Available on home machine.
- **Game Cartridge Images** - <http://www.smspower.org>
ROM dumps from original cartridges. For legal reasons, I will only download images of cartridges I actually own.

Hardware Requirements

- **Sega Master System Console**
Available at home.
- **Game Gear Console**
To be purchased from <http://www.ebay.co.uk>
- **Game cartridges**
Available at home, (20+ cartridges).

Timetable



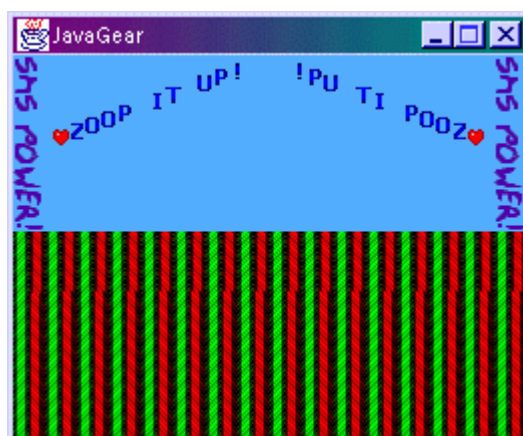
My work on JavaGear can be continually tracked on the website, www.javagear.co.uk, a screen shot of which can be seen on the left. In addition to this, I will be meeting my project supervisor fortnightly to ensure that I am meeting deadlines and focusing in the right areas.

Due to the nature of the project, the order in which the components are coded is somewhat predetermined. For example, there would be little point in coding the sound emulation first

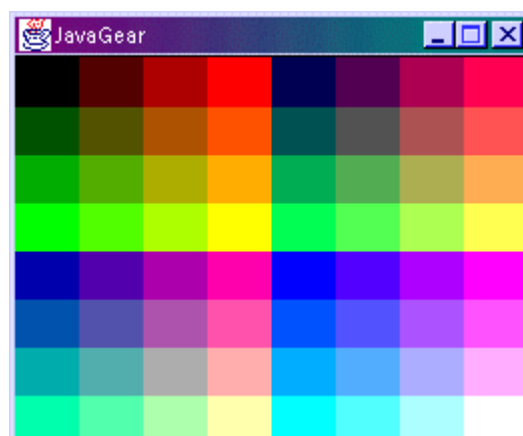
because its operation is reliant on other components. Certain components are critical to the project's success, like the CPU, memory emulation and paging registers. Therefore, the most important components will be tackled first, and those that are not mission critical will be coded at a later stage. I have indicated the importance of each task, by rating it in terms of urgency.

- **Summer 2001** 1 July 2001 – 31 September 2001

Date	Task	Urgency	Status
July 2001	Research emulation techniques, and existing emulators.	High	✓
July 2001	Gather technical information on SMS and GG.	High	✓
July 2001	Gather technical information on Zilog Z80 CPU	High	✓
August 2001	Z80 : Start coding basic structure	Medium	✓
August 2001	Start project specification.	High	✓
August 2001	Create project webpage.	Low	✓
September 2001	Holiday to Thailand.	High	✓



Zoop's SMS Power Demo, demonstrating background tiles and sprites.



Charles MacDonald's Palette Test Demo

I completed the above tasks over the summer, and even made some progress emulating the Video Display Processor (VDP), although this work is far from

complete. This has enabled me to produce a prototype, capable of running a variety of simple Master System demos. Some screen shots are provided above.

▪ **Autumn Term** 1 October 2001 – 14 December 2001

By the end of the Autumn term I hope to demonstrate a working emulator, capable of running a range of titles. The Zilog Z80 CPU core, ROM loader and VDP will be operational. Speed optimisations will not have been performed by this stage, so games are likely to run slowly.

Date	Task	Urgency	Status
Week 1	Meet Supervisor to clarify ideas.	High	✓
Week 1	Complete project specification.	High	✓
Week 2	Meet Supervisor to verify specification.	Medium	✓
Week 2	Hand in specification. (12 th October 2001)	High	✗
Week 2	MEM: Implement System Memory Map, with simple ROM loader. (32K Roms only – No paging)		✓
Week 2	Z80: Complete Intel 8080 OpCodes (250)	High	✗
Week 3	Z80: Complete ED prefixed OpCodes (70)	High	✗
Week 3	Z80: Complete documented DD prefixed OpCodes (70)	High	✗
Week 4	Z80: Implement CB prefixed OpCodes (255)	High	✗
Week 5	Z80: Implement documented FD prefixed OpCodes (70)	High	✗
Week 6	MEM: Implement Memory Paging Registers	High	✗
Week 6	VDP: Implement Data and Control Ports	High	✓
Week 7	VDP: Implement Registers	High	✗
Week 7	VDP: Implement Display Timing & Interrupts	High	✗
Week 8	VDP: Output graphics to screen	High	✓
Week 9	UI: Implement controller support	High	✗
Week 10	Complete pending tasks of 'High' importance. If they are all complete then proceed.	High	✗
Week 10	Z80: Investigate undocumented OpCodes, to see if any games make use of them. If they do, implement them.	Low	✗
Week 11	Inspection week. (10 th December 2001)	High	✗

▪ **Winter 2001** 15 December 2001 – 6 January 2001

By the end of the winter break, the emulator will have been thoroughly tested with home-brew and commercial ROM images. Compatibility will have been improved, as a result of bug fixing the Z80 and VDP emulation. Feedback will also have been gathered from Internet users, who have volunteered to test the emulator. I will also begin work on the final report.

Date	Task	Urgency	Status
Week 1	Complete pending tasks marked Urgent.	High	✗
Week 1	Compile compatibility list	Medium	✗
Week 1	Distribute on Internet	Low	✗
Week 2	Bug fixes	Medium	✗
Week 3	Bug fixes	Medium	✗

- **Spring Term** 7 January 2002 – 22 March 2002

By the end of the spring term, the code will have be complete and demonstrated. If the project is behind schedule, certain features marked with low urgency will be omitted. Whatever the state of the project, there will be a feature freeze in week 8 and the code will be optimised with speed and stability in mind.

Date	Task	Urgency	Status
Week 1	SOUND: Emulate SN76489 PSG sound chip	Medium	*
Week 3	Add Game Gear specific emulation	High	*
Week 4	UI: Create GUI	High	*
Week 5	NET: Add ability to play games over Internet	Low	*
Week 6	UI: Create sprite/tile viewer	Low	*
Week 8	Stability/Optimisation	High	*
Week 9	Preparation for Demonstration work	High	*
Week 10	Demonstration work (18 th March 2002)	High	*

- **Easter Holidays** 23 March 2002 – 22 April 2002

Date	Task	Urgency	Status
4 th April 2002	Hand project in	High	*