

## Team 14 Product Design Specification (PDS)

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### *Executive Summary:*

Team 14 will build a cheap, lightweight, simple multiplayer handheld game console. Our differentiating feature will be a “retro” feel, using pared down controls and pixel graphics that evoke the consoles of lore. It will be usable by anyone, completely self-contained, with minimal setup. The controls will be natural and intuitive so that anyone can quickly pick up the device and start to play.

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## Market Analysis

Our market analysis shows that “retro” is HOT. From wristwatches to Polaroid cameras to the Commodore 64, the youth of today are discovering the ancient tech of the last century. Our game deck will fuse modern components with an old-school aesthetic, with a clean layout and monochrome screen.

There are a large number of companies competing at the high end, with prices ranging from \$400 to over \$1200 for systems rivaling modern smartphones in power and storage. A large number of open source devices are available at the low end for the do-it-yourself crowd. Our estimate is that the Team 14 unit can be produced for approximately \$20-25, for a retail price after markup in the sub-\$50 range.

## Product Requirements

The unit must:

- Be handheld and lightweight
- Be rugged enough to withstand typical usage
- Be simple to operate without training or documentation
- Provide at least one built-in game such as Battleship™ or tic-tac-toe
- Have a bright screen and intuitive controls
- Be able to “pair” with one other unit for wireless multiplayer gaming
- Be battery powered

The unit should:

- Offer a menu of multiple games
- Be able to pair with multiple units up to 4 players
- Be open source and unencumbered by licensing worries
- Use rechargeable, rather than disposable batteries
- Have a wired power connection as a backup (if the batteries die)
- Be updatable (via Bluetooth, USB or SD card)

The unit may:

- Use a color display, rather than monochrome
- Offer a simple audio buzzer if time/cost/space permits?

## System Architecture

The design of our product is similar to the classic Nintendo Gameboy. The 3D-printed enclosure will feature an OLED screen, the primary output device which will present the user interface (UI) and game play. Input from the user will come from buttons arranged in the familiar “D-pad” (cross) shape, supplemented by several independent buttons for navigating the UI. A single microprocessor will manage all of the user interaction, game play, and wireless networking.

The product will feature wireless play with at least one other person. All of the electronics, including the wireless antenna, power regulation and battery recharger will be mounted on a single printed circuit board. The high-level architecture is shown in the following figure.

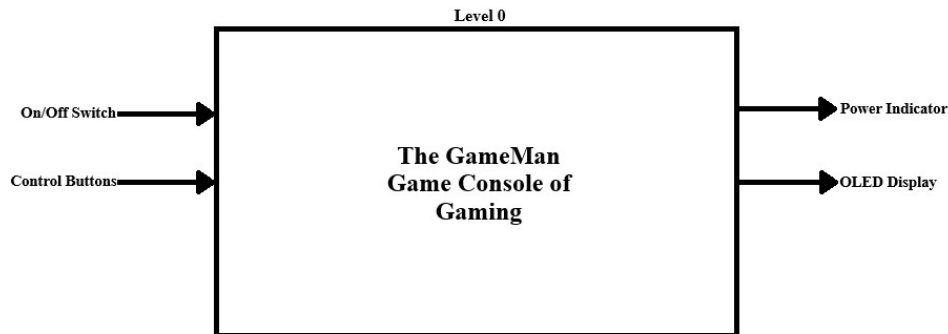


Figure 1: High-level architecture of the unit.

Power will come from an internal battery; an on/off switch with an LED indicator will be externally accessible. Optionally, a rechargeable battery with an external power connector will be included. Figure 2 illustrates the architecture and power handling in more detail.

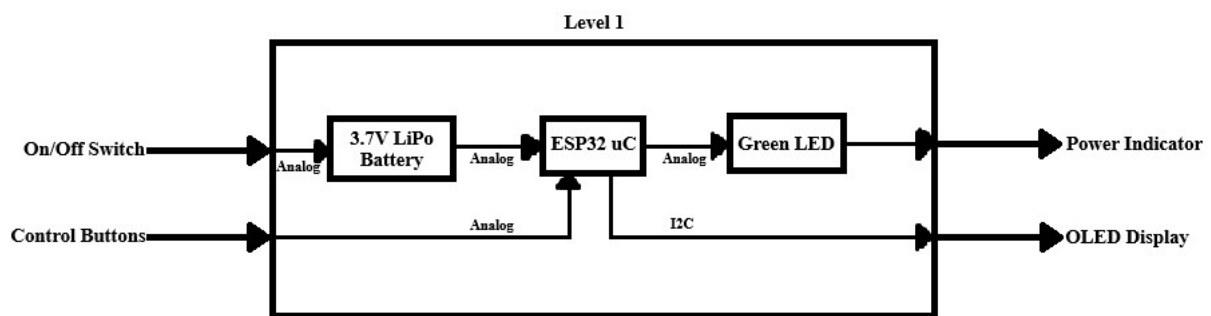


Figure 2: Internal architecture block diagram.

## Design Specification

The processor will be an ESP32 microcontroller, selected for its roomy internal storage and flexible wireless capabilities. It is also easily breadboardable for prototyping. Many different models exist with different amounts of internal memory or other features; the HUZZAH32 ESP board is a popular pre-built configuration.

Sensors will be in the form of buttons and the wireless interface. Actuators will include the display screen, and possibly a buzzer for limited audio feedback. Most of the displays are serially connected via I<sup>2</sup>C or SPI and are inexpensive. The specific dimensions (physical and pixel count) are not yet determined.

The Arduino-based software environment provides a large set of libraries to simplify custom UI and game development. Schematic capture and PCB layout will be done in KiCAD.