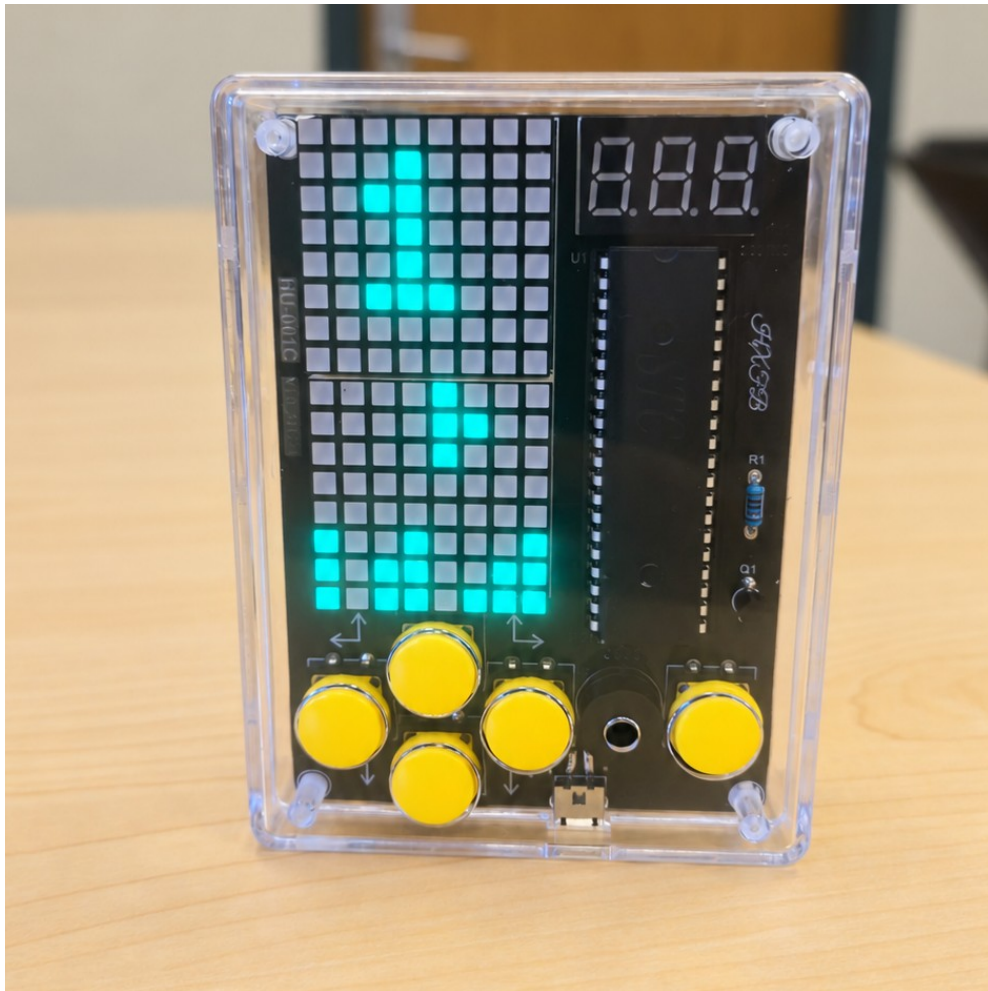


HU-001C DIY Funny Game Machine

80's Nostalgia Atari Handheld Game

Technical Project Summary | University of Colorado Colorado Springs



Completed HU-001C game machine during operation.

PROJECT BACKGROUND

Assemble and test a handheld game machine while practicing component identification, schematic interpretation, soldering, inspection, and troubleshooting.

1. Project Overview

This project is a DIY handheld gaming system based on the HU-001C Funny Game Machine kit. The assembled device uses a programmed microcontroller, five push-button inputs, an LED dot matrix display, a three-digit numeric display, and a buzzer to run several simple retro-style games. Button presses are read by the controller, which changes the game display and produces audible feedback.

The activity was designed as an introductory, hands-on electronics build. Members used the supplied PCB, components, and assembly references to identify values and orientations, solder the board, fit the casing, and test the completed system. The club assembled and tested an existing kit; designing the PCB and writing the game firmware were outside the scope of this build.

2. Objective

The objective was to construct a functional handheld game machine while gaining experience with electronic assembly, soldering, and testing. Members practiced identifying parts, reading the supplied circuit references, interpreting PCB markings, checking orientation and polarity, soldering through-hole components, and inspecting the completed circuit.

The project also introduced how a programmed microcontroller receives button inputs and controls LED displays and a buzzer in a complete electronic system. The assembled device was considered functional when it powered on, displayed gameplay, switched among games, and produced sound after needed rework.

3. Components and Materials

#	Part	Qty.	#	Part	Qty.
1	LED dot matrix screen assembly	1	11	STC15F2K60S2 microcontroller	1
2	Black push button	5	12	Buzzer	1
3	Yellow A24 button cap	5	13	Red/black wire set	1
4	Micro-USB socket	1	14	Battery metal contact	5
5	Metal-film resistor	1	15	Self-tapping screw	5
6	Ceramic capacitor	1	16	Screwdriver	1
7	Electrolytic capacitor	1	17	USB power cable	1
8	S8550 transistor	1	18	Transparent shell half	2
9	Three-digit numeric display	1	19	PCB	1
10	IC socket	1			

The quantities in the table follow the students' supplied kit list. "One LED dot matrix screen" refers to the display assembly shown in the list; the completed device visibly has two matrix sections. The list is an assembly inventory, not a verified purchasing bill of materials with electrical values or manufacturer part numbers.

4. Circuit Wiring Overview

Figure 1 is the club's existing wiring overview. It locates the controller, input buttons, display sections, and other major parts so a reader can follow the functional layout. It does not specify component values, battery and USB source selection, or a reliably readable connection for every pin. Those details cannot be inferred from this image alone. The supplied kit schematic, PCB silkscreen, and a direct inspection of the board would be required to verify exact nets or reproduce the circuit.

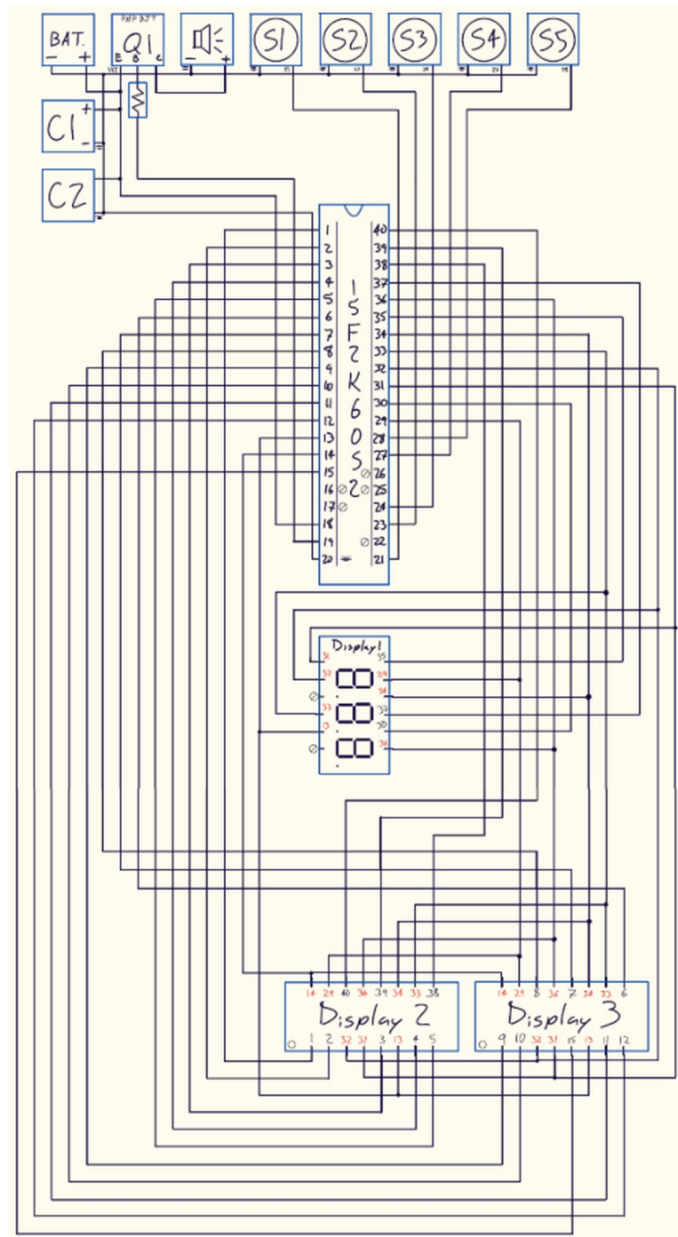


Figure 1. Existing club wiring diagram cropped from the supplied draft. Individual connections have not been independently verified.

5. Theory of Operation

Power. The AAA battery pack supplied power during the reported functional tests. Once the contacts and battery connection were corrected, the device remained on during those checks. The micro-USB socket is included in the kit, but the team did not document a USB power test or verify how the two inputs interact. The ceramic and electrolytic capacitors support stable operation; their exact locations and electrical values need confirmation from the original circuit information.

Input. The five push buttons provide electrical input states to the programmed STC15F2K60S2 microcontroller. Pressing a button changes an input state, and the firmware interprets that state in the current game. The PCB's markings helped the team place the switches; the exact controller pin assignments and pull-up or pull-down arrangement have not been verified from the available diagram.

Output. The controller drives the LED dot matrix display to show game graphics and uses the three-digit display for numeric information. The buzzer produces sound during gameplay. The S8550 transistor is installed as part of the circuit, but its particular load and switching path cannot be assigned confidently from the available diagram. These statements describe observed functions and component roles without claiming an unverified pin-level design.

Return. Each energized branch needs a return path to the supply through the ground reference. The active path depends on the button states and controller outputs; the battery current does not pass in series through every switch, display, and component. The battery-positive → active circuit branch → ground → battery-negative description is a functional model, not a claim that every part draws current at once.



Figure 2. Completed game machine with the LED matrix illuminated.

6. Assembly Procedure

- **Prepare tools and identify components.** Lay out the PCB, parts, clear shell, screws, battery contacts, soldering iron, solder, cutters, and screwdriver. Identify parts using their values and PCB markings. Check the resistor value, IC socket notch, transistor orientation, and electrolytic capacitor polarity before soldering.
- **Assemble the battery holder.** Fit the battery contacts in the positions marked for the AAA cells. Where separate leads are supplied, connect them to the marked PCB power pads with the correct polarity. The team missed this connection initially and completed it during rework.
- **Solder core electronic components.** Place the resistor, ceramic and electrolytic capacitors, and S8550 transistor in their designated footprints. Heat each pad and lead together, apply enough solder to wet both, and trim excess lead length after inspection. Check the electrolytic capacitor orientation against the PCB.
- **Solder input and output components.** Mount the five push buttons, buzzer, two LED matrix sections, and three-digit numeric display in their marked locations. Seat each part evenly and check any orientation markings before soldering all pins.
- **Solder the micro-USB connector and IC socket.** Solder the connector and socket with the microcontroller removed. Check the socket notch and inspect these joints for bridges or poor wetting before inserting the chip.
- **Install the microcontroller and button caps.** Inspect both board faces and correct loose pins, poor joints, or misplaced parts. After the PCB cools, align pin 1 of the STC15F2K60S2 with the socket marking, gently seat the chip, and fit the five yellow button caps.
- **Assemble the clear casing.** Align the populated PCB with the button, display, and USB openings. Fit the clear shell halves and secure them with the supplied screws without forcing the board out of position.
- **Install batteries and test.** Insert the AAA cells according to the holder polarity marks. Power on and check the controls, display, game switching, and audio. The battery contact problem described in Section 7 was discovered during this stage.

7. Testing and Troubleshooting

Troubleshooting

- **Excess solder.** Some joints contained too much solder, creating a risk of bridges between adjacent pads. The team reheated the joints, removed excess solder with a desoldering pump, and re-soldered with a smaller amount.
- **Incomplete through-hole joints.** Some solder joints did not wet the lead and plated barrel adequately. The team reheated them and, where needed, reworked them from the other side of the PCB. A visible fillet on both faces can help inspection, but a sound joint depends on wetting and connection rather than solder simply appearing on the opposite face.
- **Battery pack omitted.** The battery connection was missed during the initial assembly. The team added it afterward, matching the positive and negative leads to the PCB markings.
- **Component placement.** Some components were initially soldered in the wrong locations. The team removed and re-soldered them in the correct positions; the specific components were not recorded in the student notes.

- Battery holder contact. During testing, the device sometimes had no power or lost power because the AAA batteries did not make consistent contact with the holder terminals. The team extended the contact clips slightly to increase pressure against the battery terminals. After this adjustment, it powered correctly during the reported functional checks.
- The team also noted that some connections had to be re-soldered after the test leads did not make reliable contact. The student notes did not identify which pads or leads were involved, so the report does not assign a more specific failure mechanism.

Testing

Check	Observed result
Power	After correcting the battery holder contact, the device turned on and stayed powered during the team's checks.
Display	The team played the available games and reported that the LED display was clear.
Game switching	The team switched among the available games and reported that each loaded and ran.
Sound	The buzzer produced audible feedback during gameplay.

After rework, the team reported that the device powered from the AAA battery pack, showed gameplay, switched among the available games, and produced sound. The table records these observed functional checks. No voltage, current, battery runtime, exact game count, solder-joint continuity readings, or separate USB power test were recorded. Accordingly, “all tests passed” means that the listed functions worked during the team's checks; it does not establish long-term reliability or independently validate every schematic connection.

8. Engineering Concepts Learned

- Soldering technique. Heat the pad and lead together, then add enough solder to wet both without bridging neighboring pads. A shiny surface alone is not a reliable test of joint quality.
- Plated through-holes. With sufficient heat, solder wets the lead and plated barrel. Inspect both board faces and rework any joint that looks incomplete or moves.
- Rework. Excess solder can bridge adjacent pads, while a weak connection can interrupt the circuit. Remove the defect and remake the joint, then inspect it again instead of covering it with more solder.
- Polarity and orientation. Match the battery wiring and electrolytic capacitor to the board markings, and align the microcontroller with the socket. An incorrectly oriented part can stop the device from working or cause damage.
- Systematic testing and process. Checking power, controls, display, game selection, and sound separately helped narrow down faults. A placement check before soldering, an inspection of both PCB faces, and a battery-contact check before closing the case would have prevented several of the team's delays.

9. Possible Improvements

For future builds, the team would use a placement checklist and ask another member to confirm polarized parts and component locations before soldering. After each stage, the team would inspect both board faces and rework poor joints before adding more parts. Testing the battery contacts and power before the case is closed would catch the intermittent connection earlier. A clear original schematic with part values and readable net labels would also allow more detailed analysis and make future troubleshooting easier.

10. Completed Project and Contributors

The completed project is shown in Figure 3. The roles below reflect the club’s account of participation: members who worked on the schematic also assisted with soldering and assembly, and several members contributed to the written report. Project management, project leadership, technical documentation, and additional participation are credited separately.



Figure 3. Two completed HU-001C game machines.

Role	Contributors
Project Manager	Daniel Bustos
Project Leaders	Ben Foronda; William McGinley
Schematic	Noah Karavatakis; Leah Greenberg; Kaeden Wellman; Lerry Lara; Antonio Magana; Connor O’Boyle; John Johnson; Alex Flaherty
Soldering and Assembly	Noah Karavatakis; Leah Greenberg; Kaeden Wellman; Lerry Lara; Antonio Magana; Connor O’Boyle; John Johnson; Alex Flaherty; Riley Snyder; Devin Cook; William Hester
Technical Documentation	William McGinley; Kaeden Wellman; Antonio Magana; Noah Karavatakis; Alex Flaherty
Additional Contributors	Logan Hammond; Matthew Smith Baker; Cade Kennedy; other Wire Lion Engineering Club members