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Esp-ecially Great

Best Esp32 Projects in 2021



by Cherie Tan

Published Aug 28, 2021

*Many IoT, robotics, and gaming projects have been made with the Esp32.
Check out all you can do with the coolest Esp32 projects around!*

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Many in the maker community and beyond have probably heard of [Arduino](#). This series of microcontroller boards is a popular choice in education, maker, and even commercial projects. It's easy to see why: It has global community support and plenty of add-ons. There are many ways to use an Arduino, including [beginner-friendly projects](#) as well as [3D printed creations](#).

However, Arduino isn't the only option out there. Today, we'll explore one popular alternative: the Esp32. The Esp32 was developed by Espressif, the same company that released the Esp8266 microcontroller. The older board has good processing power and 17 GPIO pins, so it can handle small but impactful projects. Its Wi-Fi capability, small form factor, and low price made it a formidable contender in the world of microcontrollers.

Onboard Wi-Fi sets the Esp8266 (and Esp32) apart from many Arduino boards, especially earlier ones. Compared to its predecessor, the newer Esp32 packs in even more pins, Bluetooth support, and dual 240-MHz cores. Many IoT projects are built around the Esp32, as are robotics and gaming projects, among other applications.

Without further ado, let's check out what's possible with the Esp32!

ESP32 MICROCONTROLLER



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WEARABLES

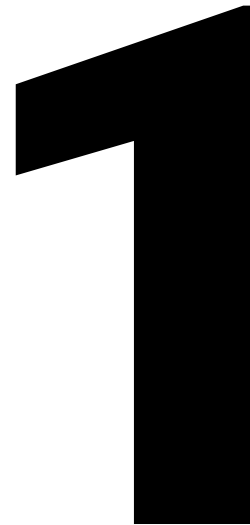
Wearables are computational devices that can be worn on the body. These days, there are affordable wearables for sale, including Esp32-based devices such as the [Lilygo watch](#).

Additionally, there are plenty of Esp32 wearables that you can build by yourself, given their ample documentation. Check a few out below!

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E-ink Digital Watch





An e-ink watch is better for your eyes and saves on battery life (Source: [Movil via Thingiverse](#))

E-paper is based on a technology that looks like ordinary ink on paper but isn't! It also doesn't require electricity to maintain the text or images displayed on a screen, only to change the display. Therefore, e-ink is perfect for low-power devices and is easier on your eyes compared to typical screens.

This maker has created a digital wristwatch based on the Esp32. It lasts up to 3 days on an 80 mA battery, as long as it connects once per day to sync the time over the internet. Just keep in mind that its firmware is based on the [Esp-IDF](#), so it won't work on the Arduino framework.

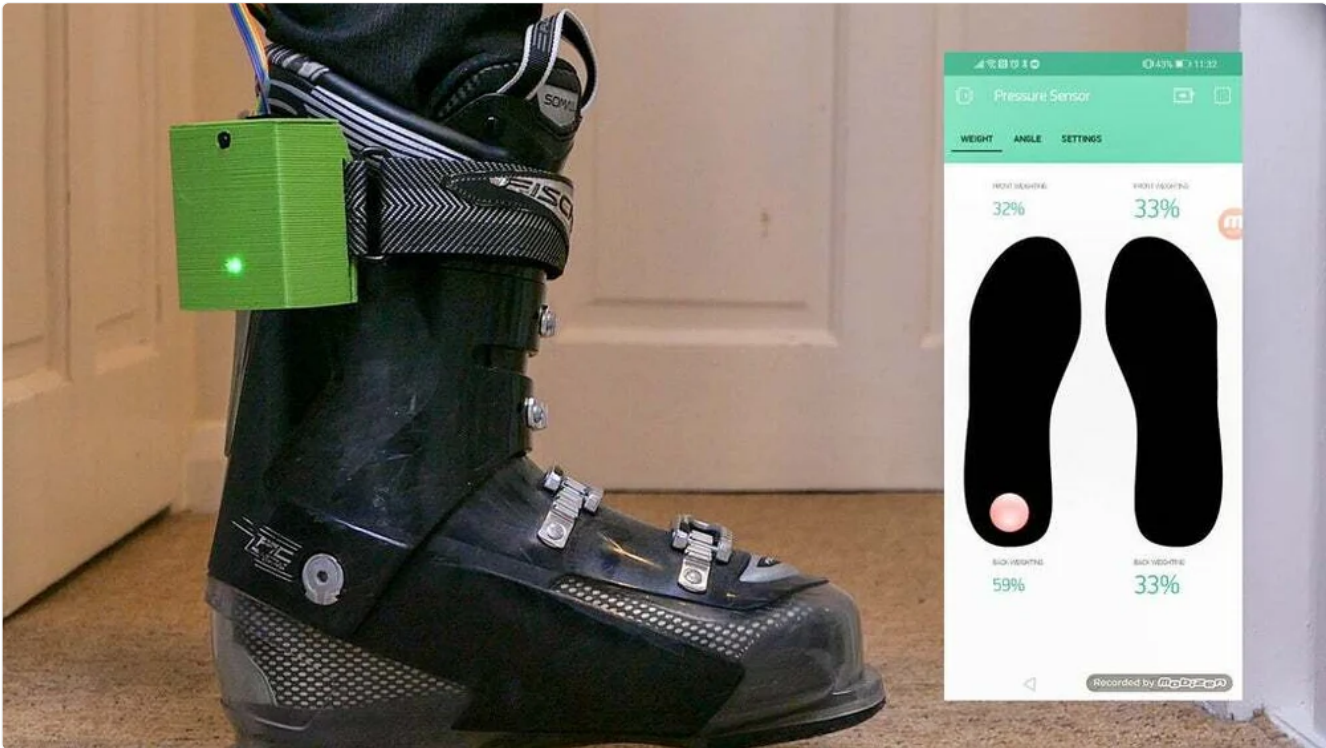
- **Who designed it:** [Movil](#)
- **Difficulty:** Intermediate
- **Core components:** [TinyPico Esp32](#), [80 mA battery](#), [ESP-IDF](#)
- **Where to find it:** [Thingiverse](#)

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Smart Insole

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Know your weight distribution and position in real-time (Source: [cabuu via Instructables](#))

Ever seen a smart insole? Neither had we! It's an especially cool project for any athletes or avid walkers. This unique wearable is an insole that's designed to be, according to the maker, minimally noticeable.

With the Esp32, the insole can monitor your weight distribution and position in real-time, sending this data to a mobile app over Wi-Fi. Alternatively, the data can also be viewed collectively at the end of a session.

- **Who designed it:** [cabuu](#)
- **Difficulty:** Intermediate
- **Core components:** 2x [Esp32](#) (1 per insole), [10k ohm resistors](#), copper tape, [Adafruit conductive sensing sheet](#), printed insole templates, [WS2812B LEDs](#), [push button switches](#), accelerometer, breadboard, 3D printed housing (optional)
- **Where to find it:** [Instructables](#)

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Presence Sensor



A presence sensing device is perfect for smart home applications (Source: [RodriMendoza via Instructables](#))

Ever wanted your devices to be activated by your very presence (or that of your smartwatch, at least)? This project uses a wearable (Apple Watch or custom Esp32 watch) to control a smart device. After connecting to whatever IoT or smart device you choose, it can trigger a proximity sensor through [IFTTT](#).

In this case, the creator's Apple Watch triggered a smart plug to turn on a lamp while they were sitting at their desk. The smart plug used here is by Techni, which is also compatible with Alexa and Google Home.

- **Who designed it:** [RodriMendoza](#)
- **Difficulty:** Intermediate
- **Core compents:** [Esp32](#), [smart plug](#) or Bluetooth-enabled device (to connect to)
- **Where to find it:** [Instructables](#)

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ROBOTICS

You may have already seen a basic [two-wheeled robot made with an Arduino](#) that's usually capable of obstacle avoidance or line following. To connect it to the internet, an Arduino usually requires an add-on.

This isn't so with the Esp32! Surveillance bots, robots capable of computer vision, and coffee-brewing robots are just some of what's easily possible with an Esp32. Check them out below!



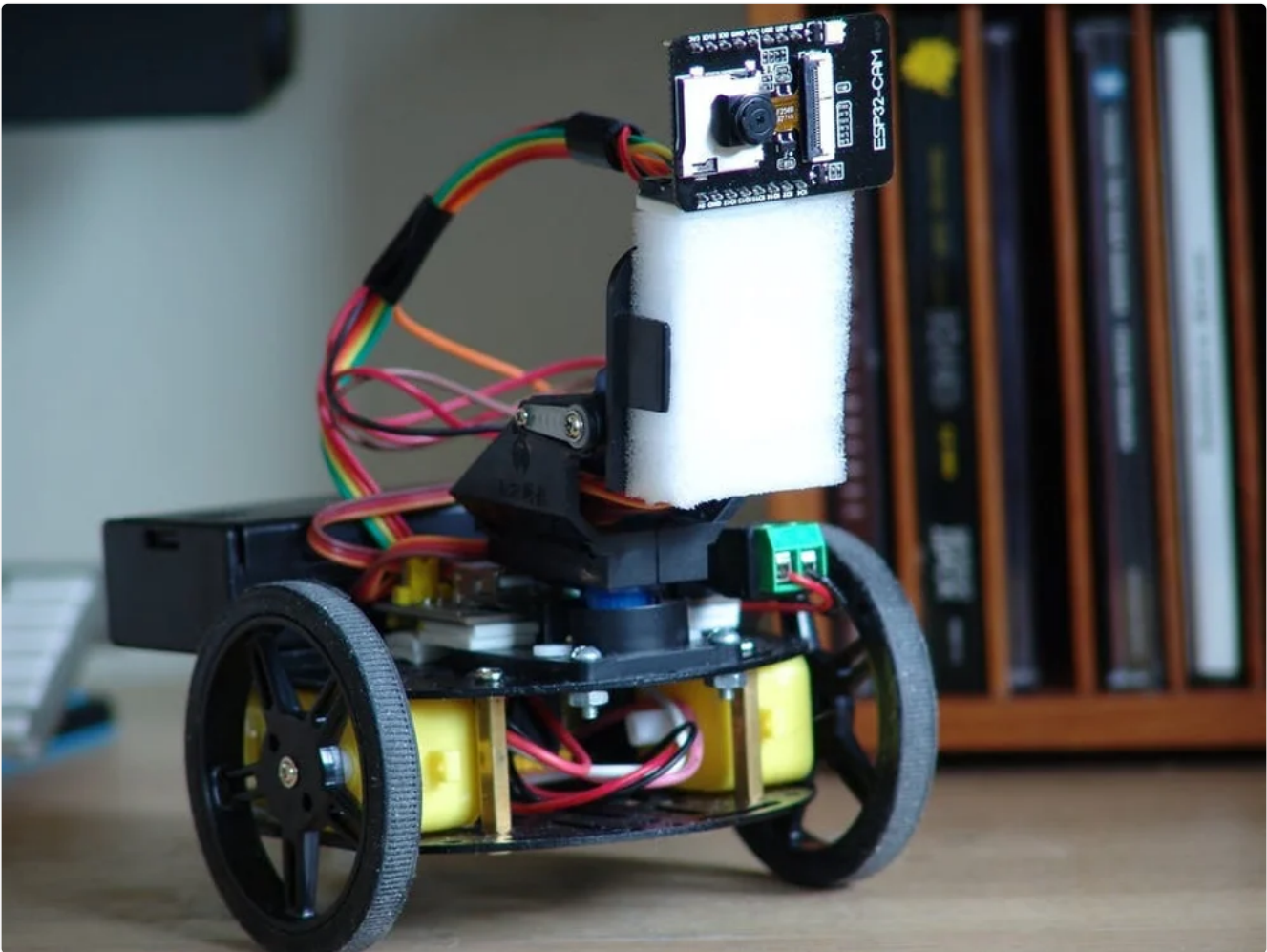
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Video Surveillance Robot



Control this little robot from anywhere, and see through its eyes! (Source: [KDPA via Hackster](#))

These days, surveillance robots can be found everywhere. They're often used for real-time monitoring for the home, workplace, healthcare settings, or even in hazardous environments. While you could build a [surveillance robot with an Arduino Uno](#) that has fire detection, what if you want to do it cheaply?

Your very own surveillance robot can now be assembled at home for a fraction of the price. This bot is controllable through the internet and a mobile phone,

and uses the camera functionality of the Esp32-Cam.

If you want to take this project a step further, you can download the [iRobbie-A app](#) (~\$6). With it, you can control the robot's movements from a joystick, while seeing a live view of the attached camera on the Esp32.

- **Who designed it:** [KDPA](#)
- **Difficulty:** Intermediate
- **Core compents:** [Esp32-Cam](#), [L298N motor driver](#), [Adafruit \(PID 3244\) three-layer round robot chassis kit](#), [18650 battery and holder](#), [MB102 breadboard](#), [mini pan/tilt camera platform](#)
- **Where to find it:** [Arduino Project Hub](#)

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Cafeino: The Barista Robot





Get a hand-poured coffee without hands! (Source: [user04650005](#) via [Arduino Project Hub](#))

Introducing Cafeino, a barista robot that's powered by microcontrollers! According to the maker, this internet-connected robot makes high-end artisanal coffee by mimicking the hand-pouring technique of a skilled barista.

Moreover, it has three brewing stations that can be customized with various recipes using a web app. To further personalize your brew, several parameters can be set such as brewing time and res, water quantity, and the hand-pouring pattern.

- **Who designed it:** [user04650005](#)
- **Difficulty:** Intermediate
- **Core components:** [Esp32](#), [Arduino Nano](#)
- **Where to find it:** [Arduino Project Hub](#)



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Robot Assistant



A robot capable of 360-degree vision (Source: [Jaime Andres Rincon Arango via YouTube](#))

No longer science fiction, assistive robots are common in this day and age. An assistive robot can be defined as a device that senses, processes sensory information, and acts in ways that benefit humans. Many assistive robots can be found in healthcare; they are utilized to monitor the health and safety of a patient, for example, those vulnerable to falls.

Having the ability to view from all angles is a good feature for an assistive robot. That's why in this build, the maker has created a robot with 360-degree vision. It's able to detect faces, identify emotions, and tell if a person has fallen.

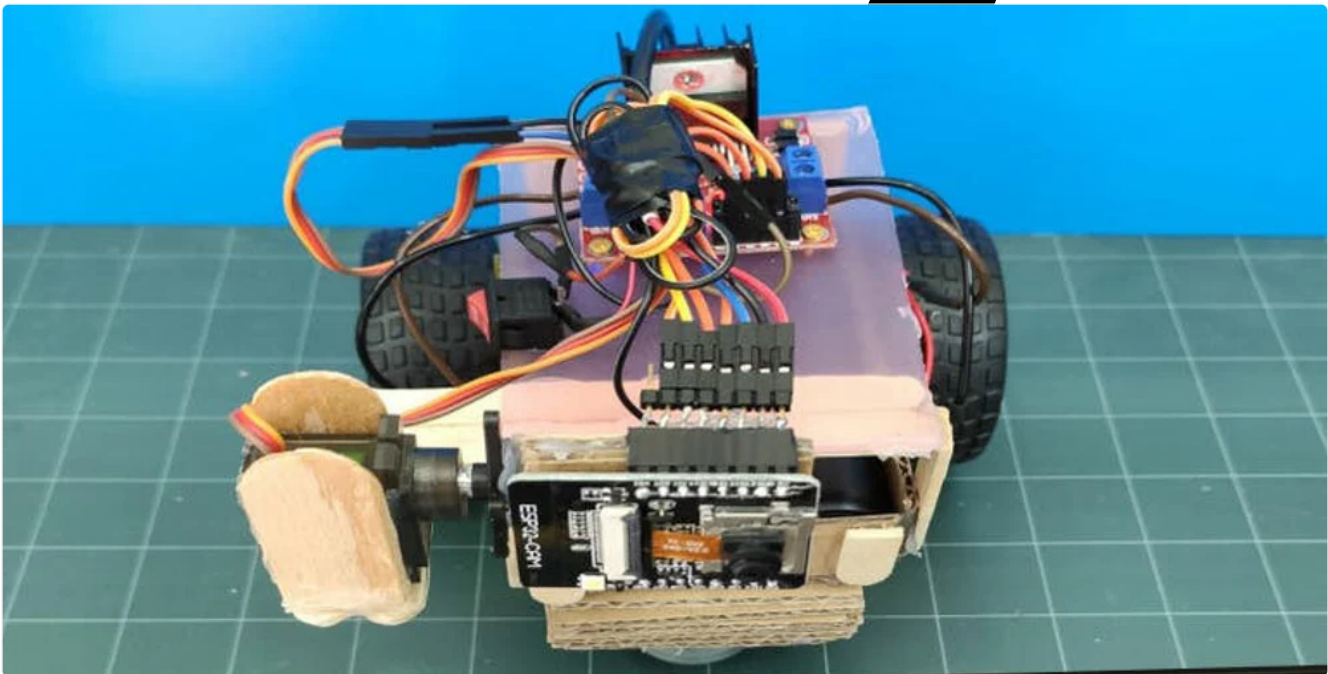
- **Who designed it:** [Jaime Andres Rincon Arango](#)
- **Difficulty:** Intermediate
- **Core components:** [Esp32 OLED](#), [Arduino Mega 2560](#), [Ricoh Theta V camera](#), 3D printed compents
- **Where to find it:** [Arduino Project Hub](#)

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AI Robot



This low-power Esp32 robot streams to an Android device (Source: [DragonPh via Hackster](#))

Microcontrollers can be used for AI or machine learning applications, too! For example, there's an Arduino-based robot that runs [neural networks](#), and a [hand-gesture-controlled mobile robot](#). But why not utilize the Esp32's built-in Wi-Fi to keep things simple?

This build is impressive and practical with its low power consumption and low-latency video streaming; it's capable of video streaming to an Android device for computer vision processing tasks such as object detection, tracking, and lane detection. You also have the ability to send control commands to the robot, like having it run autonomously in certain conditions.

- **Who designed it:** [DragonPh](#)
- **Difficulty:** Intermediate
- **Core components:** [Esp32-Cam](#), [L298N motor driver module](#), [1:120 gear motor](#), [wheels](#), ball transfer unit, [portable power bank](#)
- **Where to find it:** [Hackster](#)

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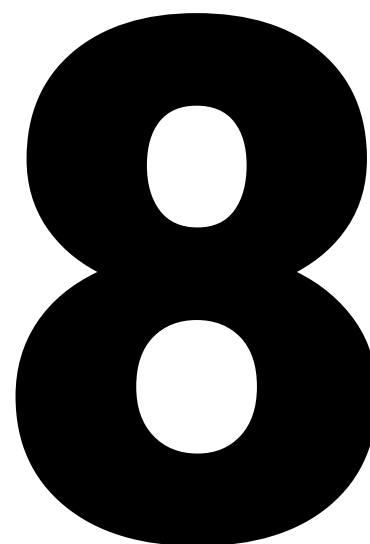
GAMING

The Esp32 is designed with Wi-Fi and Bluetooth functionality, so it's perfect for IoT applications. However, it also works well for gaming, as seen in these fun applications below.

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Handheld Game Console





Get ready to jump! (Source: [陳亮](#) via [Instructables](#))

The Nintendo Entertainment System (NES) was released in 1983 as Famicom in Japan. More recently, many retro gaming enthusiasts have gone on to emulate the classic game consoles with platforms like [RetroPie](#). There are plenty of RetroPie gaming enclosures available for 3D printing too, from [SNES](#) to [Switch](#)!

But it's also possible to build one around the Esp32. In this project, a maker has made a tiny handheld NES game console with an Esp32. For the gamepad controller, an ATtiny861 was used.

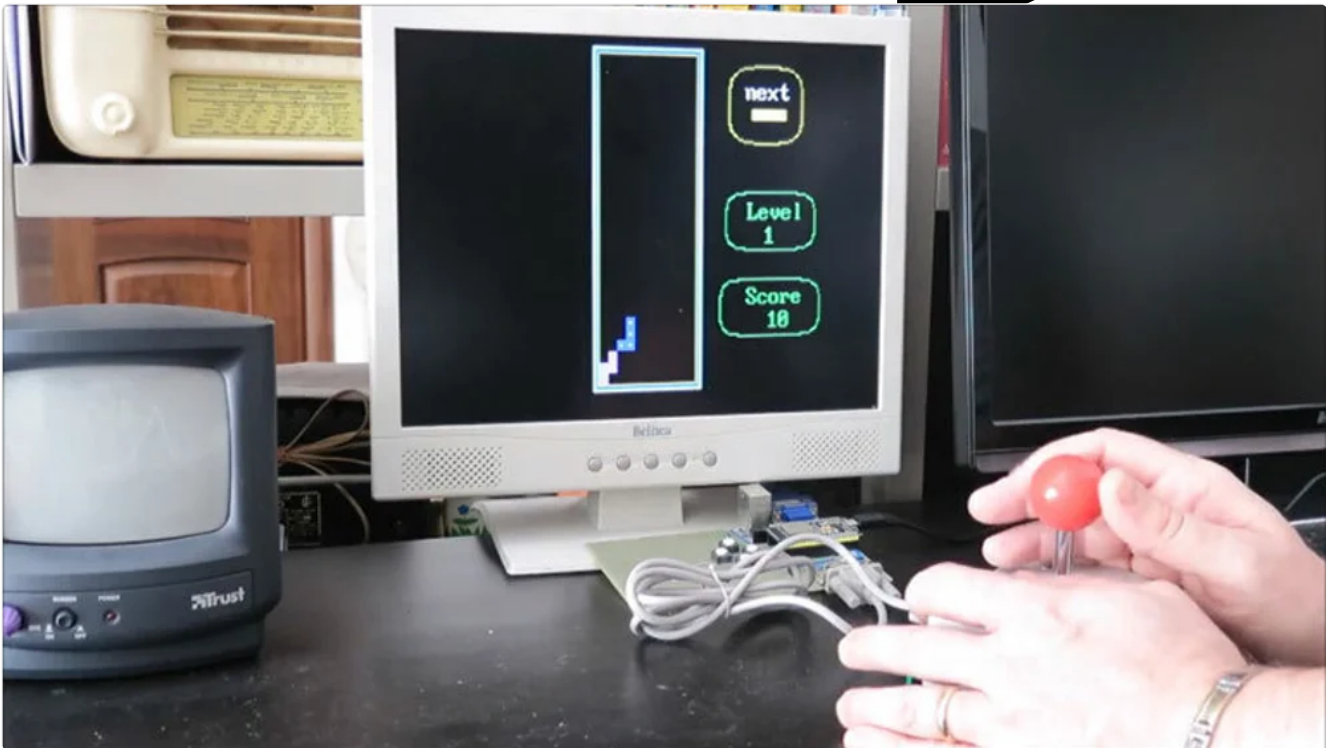
- **Who designed it:** [陳亮](#)
- **Difficulty:** Intermediate
- **Core components:** [Esp32](#), 2.4" IPS LCD display, [LiPo battery](#), 4-pin header, PETG plate, multipurpose PCB, [buttons](#), [I2C Gamepad controller](#), resistor, ISP programmer
- **Where to find it:** [Instructables](#)

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Arcade Games & Joystick



This maker reproduced retro games such as Tetris (Source: [Rob Cai via YouTube](#))

The Raspberry Pi with RetroPie is often the go-to solution for retro gaming emulation. But what if you wanted to create your own classic games from the ground up, and keep costs low? Aside from building an entire retro gaming emulation console, the Esp32 can also be used to reproduce classic arcade games!

In this project, the maker shows you how to recreate some of the classics such as Tetris, Snake, Breakout, and Bomber. These will run on the Esp32 with an output to a VGA monitor.

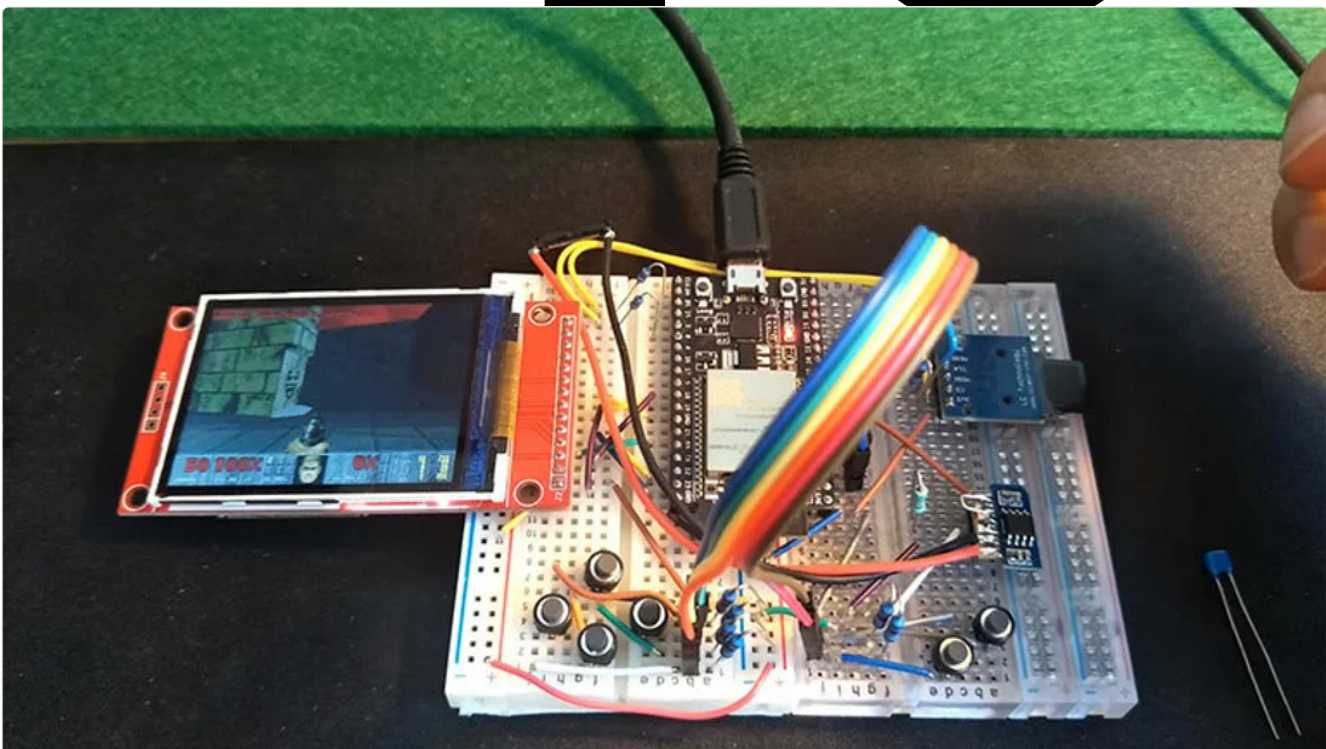
- **Who designed it:** [Rob Cai](#)
- **Difficulty:** Intermediate
- **Core components:** [Esp32](#), VGA connectors (9-pin and 15-pin), resistors, [joystick](#), VGA monitor (or HDMI adaptor)
- **Where to find it:** [Instructables](#)

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Doom

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Playing Doom on an Esp32 is also possible! (Source: [Gadget Workbench via YouTube](#))

There have been a few projects that run Doom on the Esp32, ever since it's been available on [Espressif's GitHub](#). However, this maker has gone on to modify and customize it.


This build uses an SD card that loads up the WAD files. It's also got an audio amplifier connected to a tiny speaker. An LCD display is connected to the Esp32 and the game can be controlled with momentary push button switches. All episodes of Doom available are demonstrated by the creator!

They've provided you with the [schematics](#) as well as [modified source code](#). You can even swap the momentary pushbuttons with breadboard-friendly, [soft tactile buttons](#).

- **Who designed it:** [Gadget Workbench](#)
- **Difficulty:** Intermediate
- **Core components:** [Esp32 Wrover](#), SD card module, SD card, buttons, [ILI9341 LCD display](#), capacitors, resistors, jumper wires, audio amplifier, speaker
- **Where to find it:** [YouTube](#)

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Lead image source: [Matthew James Bellafaire via Hackaday](#).

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