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Raspberry Pi Pico Wireless Connectivity Solutions

👤 Matthew

Raspberry Pi Pico

Raspberry Pi Pico is a trending microcontroller board recently launched by the Raspberry Pi Foundation. It uses a Cortex M0+ 2-core microcontroller with 133Mhz, high performance, I2C, SPI, UART, PWM, adc, and USB 1.1 hosts, and is in the spotlight by developers and makers for its very low price. As a result, Raspberry Pi Pico is used to implement various IoT ideas, and like Arduino,

several solutions are coming out to communicate with other devices. In order to communicate with other devices, wired communication or wireless communication is required. In this post, I will briefly introduce the types of wireless communications used in the Internet of Things (IoT).

1. Wi-Fi

One of the first things that comes to mind when users think of wireless communication is Wi-Fi. Wi-Fi is used in many products because it is an NFC that requires high-speed wireless connectivity, mainly for short distances of around 100 meters. It is easy to access, has a wide range of Wi-Fi zones, and allows electronic devices to connect to a wireless LAN. To use Wi-Fi on Raspberry Pi Pico, it is common for users to connect directly to the Wi-Fi module; however, WIZnet's WizFi360-EVB-Pico allows users to utilize the Raspberry Pi Pico without a separate circuit configuration. WIZnet released the WizFi360-EVB-Pico so users can utilize the Raspberry Pi Pico's development environment without much complication.

The WizFi360-EVB-Pico is a very attractive IoT Wi-Fi solution for various developers and makers, available at a very reasonable price of around $10, while providing various functions such as AWS/AZURE and support for various platforms such as Arduino/Arm.

WizFi360-EVB-Pico

2. Bluetooth

Bluetooth is the most used NFC technology standard for IoT and is used when low-power wireless connectivity is required over ultra-short distances of around 10 meters. Bluetooth is widely used in peripheral devices because of its convenience and good cost performance. HC05 and HC06 are typical Bluetooth modules that are easier to use compared to other Bluetooth modules, and are very inexpensive, attractive to developers and manufacturers, and used for home IoT, drones, RC cars, and speakers using short-range communication.
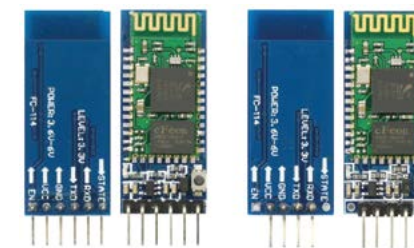
3. NFC / ZigBee / LoRa

In addition to Wi-Fi and Bluetooth, the most popular wireless solutions may be NFC, ZigBee, and LoRa. NFC is one of the wireless tags (RFID) technologies that sends and receives various wireless data within 10cm, and its short communication distance provides relatively good security, low cost, and unlike other communication methods, there is no need to set a time period. It is currently built into smartphones and used in various fields, such as transportation cards, credit cards, membership cards, etc. ZigBee is the standard for low-power Wireless Mesh Networks, and because of its low-cost characteristics, it can be deployed in a wide range of areas for wireless control and monitoring purposes, and can provide high reliability and broad range through mesh networking.

The last communication I'm going to introduce is LoRa, which can communicate with long distance connections and low power. LoRa is an unlicensed communication technology made by LoRa Alliance that can communicate up to 16 km (10 Mile). It communicates based on the node numbers assigned to its sensors without the need for a separate USIM. Communication speed is slower than LTE or Wi-Fi, but long-distance communication is possible, making it functional for low-power monitoring products.

4. Conclusion

In this article, we looked at some of the wireless communications that can be used in Raspberry Pi Pico. As each communication has distinct characteristics, it would be good to refer to it when developers or manufacturers implement wireless communication ideas. I also believe that the inexpensive, easy-to-use WizFi360-EVB-Pico is the solution when needing Raspberry Pi Pico-based Wi-Fi communication.

II

Can Arm unlock the potential of the IoT industry?

YB

Why is there so much competition in utilizing Arm's interface? In the industry, there has been a rise in competition when it comes to taking the lead in the Internet of Things (IoT) world, but has IoT grown faster than expected? According to Gartner, it was predicted that IoT growth will accelerate at an exponential rate with the development of the Cloud. Whereas cloud's popularity and usage has grown rapidly, IoT seems to have not. Apparently, it even appears to be slowing down, likely due to the scarcity of devices compatible with IoT.

A large proportion of 'things' under IoT consists of MCU-based devices, and in consequence, software compatibility for re-using components has long been the on-going puzzle. This is truly important because the IoT industry has a much higher hardware-level diversity than PCs and data centers. Organizations such as Open Connectivity Foundation (OCF) and Connectivity Standard Alliance (CSA) have put in vast effort for IoT compatibility. CSA is also leading the development of 'Matter', Samsung's IP-based home IoT communication standard. 'Matter' is also an IoT Hub for linking and controlling smart home devices.

Arm opened two projects for IoT compatibility in the summer of 2021., with the ambition to unlock the potential of IoT industry by expanding access to software and tools. This resulted in an Arm based Cortex microcontroller with Open-CMSIS-Pack software interface, which enabled the reuse of an IoT device code in a cloud called 'Keil Studio Cloud.' Arm believes it is a fundamental approach, and developers of IoT, machine learning, and embedded MCU software say anyone could increase productivity in the open developmental tools and environment provided by Arm.

Wizwiki W7500

Back in 2014, Arm released an IoT device platform called Mbed; an online collaboration tool for IoT developers. But Mbed now provides developers with wide range of resources, from its Mbed Library to individual hardware components and developments boards, Mbed OS, and Mbed TLS. WIZnet registered the WIZwiki Platform with its internet MCU, W7500P, and continue to collaborate with the Arm Mbed ecosystem.

Back to present, Arm's Keil Studio Cloud's open project is expected to quickly spread utilizing and absorbing the Mbed platform; and WIZnet's latest Wi-Fi module, WizFi360 was selected as the official Wi-Fi Shield for this particular project. WizFi360 users can easily implement Wi-Fi functions by registering the WizFi360 driver registered in Arm's CMSIS-Driver with a port number and can simply implement the Cloud such as AWS and Azure in Keil Studio Cloud.

WizFi360

Keil Studio Cloud provides a portal service where software developers can cooperate with each other by sending and receiving feedback by submitting examples. Arm Cortex-based microcontrollers and driver implementations for Wi-Fi connections are managed and shared on GitHub. Crowdsourcing is also available through open hardware communities such as Arduino, Raspberry Pi, and Mbed. We eagerly look forward to Arm's open project for IoT compatibility to unlock the true potential of future IoT industry.

arm KEIL
Keil Studio Cloud

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Arm CMSIS / KEIL / DRIVER Implementation Products

👤 Jake

WIZnet intends to continue to synchronize new products with SW development platforms collaborate with ARM(Keil)/CMSIS as their silicon partner.

ARM CMSIS/KEIL & WIZnet

The CMSIS-Driver specification is a software API that describes peripheral driver interfaces for middleware stacks and user applications. The CMSIS-Driver API is designed to be generic and independent of a specific RTOS making it reusable across a wide range of supported microcontroller devices. The CMSIS-Driver API covers a wide range of use cases for the supported peripheral types, but can not take every potential use-case into account. Over time, it is indented to extend the CMSIS-Driver API with further groups to cover new use-cases.
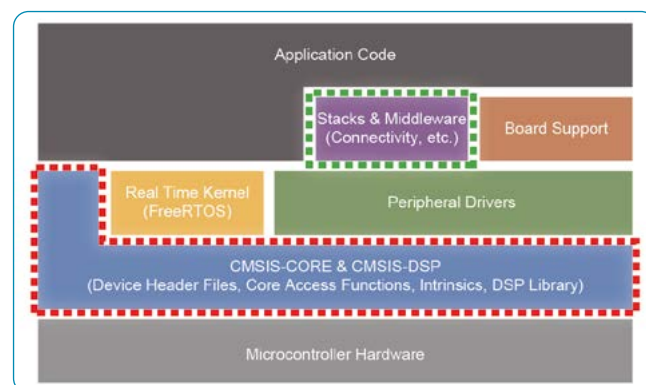(source: https://arm-software.github.io/CMSIS_5/Driver/html/index.html)

Below are the SW development platforms from the major MCU manufacturers.
(refer to the RED & GREEN box)
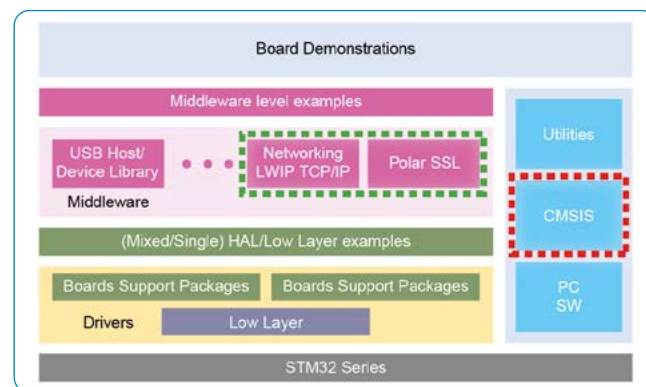
STMicroelectronics

NXP

Based on the cases above, we can categorize the SW development platforms as below

SW Development Platforms	Examples	Details
(1) MCU SDK from chip manufacturers	RP2040 SDK	Basic SDK's are provided (CMSIS Core/DSP/DAP is used)
(2) S/W Framework from chip manufacturers	STM32Cube(ST), MCUXpresso(NXP), ...	SW components and other platforms are provided besides basic SDK (CMSIS Core/DSP/DAP is used)
(3) H/W Based IoT development platform	Arduino, Adafruit.....	Unique SW development platforms are provides based on (1) & (2) above (CMSIS Core/DSP/DAP is used)
(4) S/W Based IoT development platform	Micropython, FreeRTOS (AWS), ThreadX (Azure),....	
(A) IoT development platform from ARM	Mbed	CMSIS Core + Mbed Components
(B) IoT development platform from Keil(ARM)	Keil with CMSIS package	CMSIS Core/DSP/DAP/RTOS/NN/Driver...

In most cases, MCU manufacturers provide basic SDK or their own unique SW development platforms.
Below are the SW development platform block diagram from ARM Mbed and Keil.
(refer to the RED & GREEN box)

The most commonly used SW development platform among the above are from (1) to (4).
Case (1) & (2) are used in mass-production commercial industry, whereas (3) & (4) are used more in the Open Source community.
As for (A) & (B), we speculate ARM is attempting to remodel Mbed, its end-to-end platform (silicon/SW development/cloud), and expand their SW platform by adding the CMSIS feature
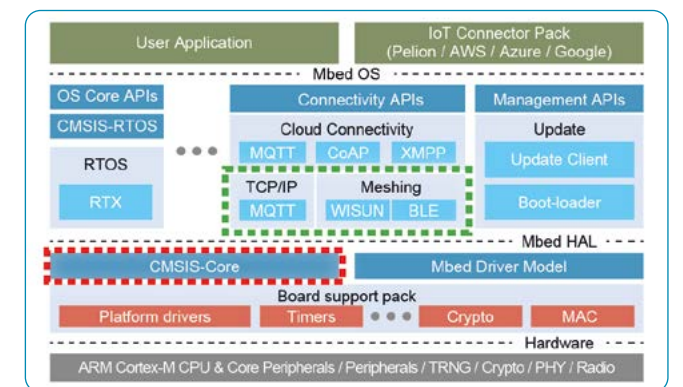(https://www.open-cmsis-pack.org/) after acquiring Keil.
WIZnet intends to continue to synchronize our products with SW development platforms (1) to (4), and also collaborate with ARM(Keil)/CMSIS as their silicon partner.
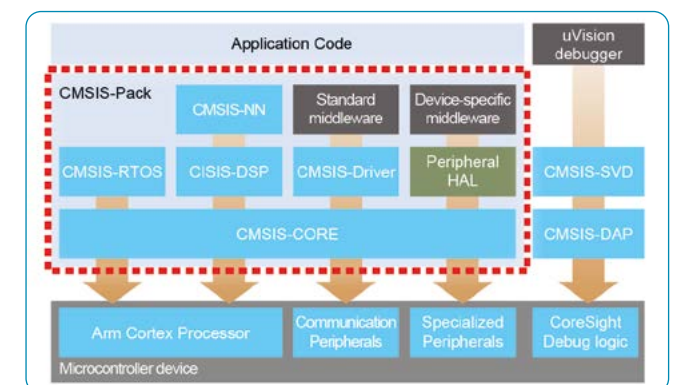The two new upcoming WizFi360-Pico and W2E Gateway Pico are using references from ARM CMSIS and Keil.
Product details: WizFi360-EVB-Pico & W2E-Gateway-Pico
https://arm-software.github.io/CMSIS-Driver/General/html/driver_WiFi.html
https://developer.arm.com/tools-and-software/embedded/keil-mdk/learn/iot/wifi-shields

ARM mbed

ARM KEIL

II

WizFi360-EVB-Pico!
Rev 1.0

Raspberry Pi Pico

Meet our latest board WizFi360-EVB-Pico!

Viktor

In May 2022 WIZnet released WizFi360-EVB-Pico - RP2040-based evaluation board for WizFi360 Wi-Fi Module. It is pin compatible with Raspberry Pi Pico board and can be used for IoT Solution developmnt.

Available for purchase at $6.95 WizFi360-EVB-Pico is one of the most cost-effective and powerful solutions for prototyping home and industrial IoT devices.

| Main features of WizFi360-EVB-Pico	
	· RP2040 microcontroller with 2MByte Flash
	· Dual-core cortex M0+ at up to 133MHz
	· 264kByte multi-bank high performance SRAM
	· External Quad-SPI Flash with execute In Place (XIP)
	· Includes WizFi360-PA (detail description below)
	· Includes 16M-bit Flash Memory
	· Micro-USB B port for power and data (and for reprogramming the Flash)
	· 40 pin 21x51 'DIP' style 1mm thick PCB with 0.1" through-hole pins also with edge castellations
	· 3-pin ARM Serial Wire Debug (SWD) port
	· Built-in LDO

To find more details please refer to   https://docs.wiznet.io/Product/Open-Source-Hardware/wizfi360-evb-pico/

Board is available for procurement   https://eshop.wiznet.io/shop/module/wizfi360-evb-pico/
at our online store:

What is WizFi360?

WizFi360 enables microcontrollers to connect to 2.4Ghz Wi-Fi using IEEE 802.11b/g/n standards. The module has been designed to provide designers with a simple Wi-Fi solution. For easy migration from ESP8266, WizFi360 supports Espressif-like AT command list.

The following attributes of WizFi360 were extracted from its datasheet
(see: https://docs.wiznet.io/Product/Wi-Fi-Module/WizFi360/documents)
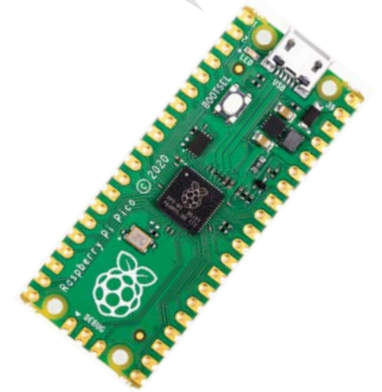
WizFi360

Wi-Fi 2.4G, 802.11 b/g/n

· Station / SoftAP / SoftAP+Station operation modes
· UART / SPI interface
· "Data pass-through" and "AT command data transfer" mode
· Baudrate up to 2Mbps with 16 common values
· Support firmware upgrade by UART Download / OTA (via WLAN)
· Industrial grade (operating temperature range: -40°C ~ 85°C)
· CE, FCC, KC, K-MIC(TELEC), RoHS, REACH certification

WizFi360 comes into two options: with onboard pattern antenna or u.fl connector. WIZnet also provides internet-offload (io) modules with various form factors. WizFi360io-C is interface board with SMW200-06 connector and 5V support, WizFi360io-H is pin-header type interface board with 2.00mm pin header.

WizFi360 is small but powerful module that supports SSL using MbedTLS library. After its release, WIZnet also certified WizFi360 to be used with Microsoft Azure. For easier cloud configuration WIZnet implemented custom AT commands for saving cloud certificate & private keys into WizFi360.

If interested in bulk orders of WizFi360 visit our new service https://direct.wiznet.io

Available software support?

WIZnet already released C/C++ SDK and sample codes. (https://docs.wiznet.io/Product/Open-Source-Hardware/wizfi360-evb-pico/). CircuitPython and MicroPython SDK are being prepared too.

C/C++
MicroPython
CircuitPython
SDK

To conclude

Wi-Fi module WizFi360 is a perfect choice for mobile wireless applications such as remote monitoring and sensor applications. Ease of integration and programming can vastly reduce development time and minimize system cost. Depending on your project needs, WIZnet is ready to offer firmware customization services. Should it be custom AT-command or application-specific program, we are ready to support all!
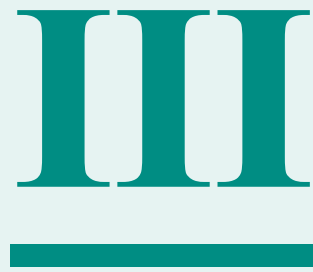
III WizFi360 User Created Contents

Lawrence

(Python) How to add WizFi360-EVB-Mini to Raspberry Pi Pico

The WizFi360 provides AT commands for users to utilize various Wi-Fi functions, allowing users to connect easily to the familiar open hardware platform. This project demonstrates the use of AT commands through UART by connecting the WizFi360 modules to the Raspberry Pi Pico. It is also based on Python and illustrates the developmental environment of IoT.

URL https://www.hackster.io/louis_m/how-to-add-wizfi360-evb-mini-to-raspberry-pi-pico-python-8c62c1

(C/C++) Connect WizFi360-EVB-Pico to AWS IoT Core

The WizFi360-EVB-Pico board is designed to easily utilize Wi-Fi functions by connecting the WIzFi360 and RP2040 onto on board without additional hardware. The project introduces how to access AWS IoT Hub through MQTT communication methods and provides C/C++ example code.

URL https://www.hackster.io/user1959920/connect-wizfi360-evb-pico-to-aws-iot-core-3bb1cc

(Arduino based Wi-Fi board) OrangeBoard WiFi+

The OrangeBoard WiFi+ is an Arduino-compatible Wi-Fi module manufactured by a Korean company called Kocoafab. The main controller chip uses ATmega2560 and offers 10-channel analog, 30 GPIO pins and 2 UART interfaces. It is compatible with Arduino IDE and provides various functions for its users.Example: Using OrangeBoard WiFi+ with Thingspeak
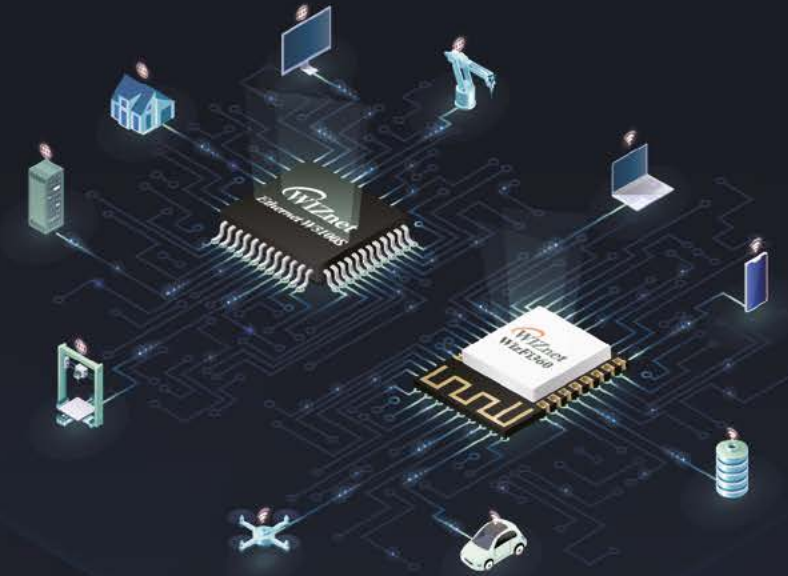
URL https://kocoafab.cc/product/orangewifiplus
https://kocoafab.cc/tutorial/view/787

IV WIZnet Design Contest 2022

Ethernet HAT Contest for Raspberry Pi Pico

Sophia

WIZnet Ethernet HAT Contest 2022

for **Raspberry Pi Pico** and **RP2040 projects**

What can you achieve if RP2040 had access to Ethernet?

WIZnet is well known among makers due to the connection between its embedded solutions and Arduino Ethernet Shields; furthermore, WIZnet is actively involved in the flow of various open-source hardware ecosystems. In addition to the role as a fabless semiconductor company, WIZnet has hosted design contests with new products to allow innovative designers and engineers implement various ideas and contribute to the open-source hardware/IoT market. Last year's "WIZnet Ethernet HAT Contest 2022" was an IoT idea competition worth $30,000, where WIZnet provided samples of W5100S-EVB-Pico or WIZnet Ethernet HAT, in celebration of the launch of WIZnet's Ethernet collaboration with Raspberry Pi Pico (RP2040).

Raspberry Pi Pico is a low-cost, easy to use, high-performance microcontroller (MCU) board made from Raspberry Pi. As a result

of this new product, WIZnet also introduced a new low-cost product that is compatible with RP2040 plus ethernet function. WIZet's new product allowed users to implement IoT ideas with the RP2040 without separating the circuit configuration.
Free samples were shipped upon initial idea submissions, with more than 230 teams participating from 30 different countries.

The contest featured many unique and innovative projects including the Ethernet Can Gateway, AI-based 3D printer motion detection and monitoring, PoE, WIZcube, classic vintage phones, and more. More information about the contest can be found on the WIZnet Maker site (maker.wiznet.io). We at WIZnet would like to thank the many 'Makers' who took the opportunity to implement and present their wonderful projects.

Contest Award-Winning Contents

Matthew

The content below shows a few of the contest winners.
To see the full list of winners and their projects, follow the link below.

URL https://maker.wiznet.io/wiznet-ethernet-hat-contest-winners/

AI-driven IoT 3D Printer Motion & Status Tracker w/ Telegram

This project is one of WIZnet's Etherernet HAT Contest 2022 award-winning projects that tracks vertical and lateral moverments of a 3D printer via AirTags. It allows users to get informed of malfunctions related to motion via Telegram. It's a great piece of IoT 3D Printer Motion & Status built from an AI Camera, Raspberry-Pi-Pico ,and WIZnet's Ethernet HAT. Its detailed step by step information is easy to follow and available.

URL https://maker.wiznet.io/2022/01/26/iot-3d-printer-movement-and-status-monitor-w-telegram/

Ethernet CAN Gateway
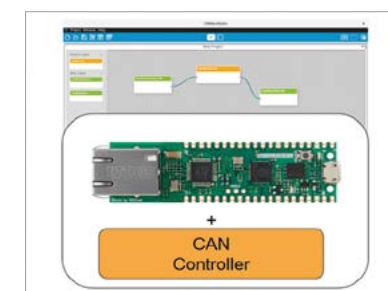
If you are interested in communication used in cars, you should consider the CAN communication device. This project is an Ethernet to CAN Gateway project, utilizing the W5100S-EVB-Pico and the CAN module MCP2515. This project is also detailed in a Step-by-Step process, from PCB to Firmware Source/Case, making it easy to follow for those who make Ethernet to CAN Gateway.

URL https://maker.wiznet.io/2022/01/08/ethernet-can-gateway/

Rotary Dial Remote Control for Home Automation

Don't you remember the rotary dial classic phones?
This project converts the classic phone to a Remote Control and Alarm for Home Automation. If you are looking for a classic feel for a Home Automation System, follow the link below.

URL https://maker.wiznet.io/2021/12/17/rotary-dial-remote-control-for-home-automation/

IV

WIZnet Design Contest 2022

Contest Winner Interview
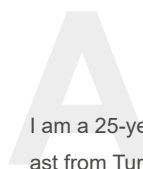
👤 Jo

Name
Kutluhan Aktar

Project Name
AI-driven IoT 3D Printer Motion & Status Tracker w/ Telegram

Q Tell us a bit about yourself. (name, age, location, job/profession, etc…)

A I am a 25-year-old self-taught full-stack developer, maker, and electronics enthusiast from Turkey. I was graduating from physics to become a theoretical physicist. However, I left college in my second year to pursue my vocation to create my project ideas.

How did you find out about our contest?

I learned about your contest via your official Twitter account.

What did you think about the product sampled in the contest?

I really enjoyed building a project with the WIZnet Ethernet HAT. It makes developing IoT projects with the Raspberry Pi Pico effortless.

What were some difficulties you faced using our product in the contest?

I did not encounter any problems regarding the hardware. However, I needed to fix lots of incompatibilities between different libraries in MicroPython, especially with the Adafruit_wiznet5k library.

What inspired you to use the product the way you did?

Since my FDM 3D printer does not provide Internet connectivity or an early warning system to monitor the printer motions and status, I decided to create an IoT device to track the printer's lateral and vertical motions while printing so as to get informed of potential malfunctions related to the printer movements.

Would you recommend our products to anyone?

Of course, I would highly recommend your products to makers and developers working on IoT projects with the Raspberry Pi Pico.
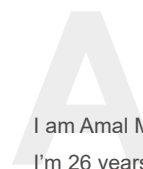

Name
Amal Mathew

Project Name
Be Awake! IP Hardwired Nurse Call System

Q Tell us a bit about yourself. (name, age, location, job/profession, etc…)

A I am Amal Mathew. I'm a firmware engineer by profession and maker by passion. I'm 26 years old. I work as a firmware engineer in a company called Confident Electronics. Our company offers end to end embedded solutions for businesses and OEMs. It is located in Bangalore, India. I have 3 years of experience in Firmware development. I have a bachelor's degree in Mechatronics.

How did you find out about our contest?

I had an idea of building a nurse calling system in my bucket list for several months. So, I thought "let's do this". For me, this contest was a bit more interesting.

What did you think about the product sampled in the contest?

According to me combining, WIZnet Ethernet HAT and Raspberry Pi Pico opens lot of opportunities to ideas. If we will look into other participants from the contest, we can tell that there are infinite applications with this Controller.

What were some difficulties you faced using our product in the contest?

It was my first time working with W5100S chip and Raspberry Pi Pico. As I had experience with W5500 chip, it was much easier for me in the development stage. Instead of MicroPython I decided to go with C SDK. I had very little struggle during this project. I had some issues with the DHCP related part. I used to work on this project after my regular work hours. I still remember, I slept only 3 hours that day when I faced issues on DHCP related firmware issues.

What inspired you to use the product the way you did?

As I mentioned earlier, I had the idea of building ip hardwired nurse calling system. In my case, In the right time I heard about this contest, At that time, I was working on a similar chip, and I had the idea too, all these factors inspired me to do this project.

Would you recommend our products to anyone?

Sure, As I mentioned earlier, we were using WIZnet's W5500 on one of the project. And now I have a good experience from the W5100S series too

IV WIZnet Design Contest 2022

WizFi360 Contest

Sophia

WIZnet will be holding another contest in June and offer free samples to our participants to encourage the advancement of IoT ecosystem and to coexist with other vendors. While the focus of the last contest was ethernet functionality, this upcoming contest will primarily focus on Wi-Fi functionality featuring our WizFi360 products. WizFi360 is registered as Arm's official shield for Open-CMSIS-Pack and is officially registered and used on various platforms such as Azure Certified. WizFi360 supports AWS AT Command as well as AWS SDK, and also supports various development environments, such as Arduino, C/C++, Python, FreeRtos, and more. All these functions make it easy for WizFi360 products to assist in connecting to the wireless network. The products to be sampled for this contest are the WizFi360-EVB-Pico (a Raspberry Pico based Wi-Fi solution), WizFi360-EVB-Mini, or WizFi360-PA module.

We are offering the latest Apple iPad Pro to 30 winners, so we welcome your creative ideas and participations once again!

For more information, please visit WIZnet Makers Site(URL: https://maker.wiznet.io).

WizFi360

- Official Wi-Fi Shield on ARM Open-CMSIS-Pack and Keil Studio Cloud
- Easy-to-connect Wi-Fi to Pico RP2040
- Azure Certified / Supports AWS SDK Examples

Free Sample

More details at maker.wiznet.io

WizFi360-PA   WizFi360-EVB-Mini   WizFi360-EVB-Pico

Contest begins	Apply & get a free sample	Submissions close	Winners announced by
June 20	July 31	September 30	October 17

30 Winners will receive **Apple iPad Pro($1,099)** 12.9-inch 128GB Wi-Fi

Documents
docs.wiznet.io

Tech Support
forum.wiznet.io

Online Shop
eshop.wiznet.io