

VSense Prototype

The objective of the project was to produce a mains monitoring and controlling device - the "HUB".

This device would be able to detect the presence or absence of 220 V AC voltages in a cable.

The detected state of "power on" or "power off" to be communicated by ESP-NOW WiFi messages to slave devices.

The purpose of the system is to control appliances ON or OFF when a MAINS 220 V AC is available.

This would allow intelligent use of a backup generator based power source for a household.

Assumptions

1. The cable being monitored would be of the type containing LIVE single core only (e.g. single "hot" wire).
2. Modification to monitor multi-core LIVE / NEUTRAL and LIVE / NEUTRAL / EARTH cable is possible.
3. Any voltage below ~ 90 V AC would be considered "OFF".
4. The HUB would be capable of signaling up to 8 slave devices.
5. Slave devices would be "PAIRED" with the HUB to build a defined set of appliance controls.
6. The HUB would be easy and safe to use for a non-trained user and NOT require the services of an electrician.

Operation

The HUB device has a hard attached antenna in the form of a thin cable of length suitable to wrap around the mains cable.

And a Velcro strap to allow attachment to that cable.

The VSense project deliverables:

1. 4 x HUB controller devices.



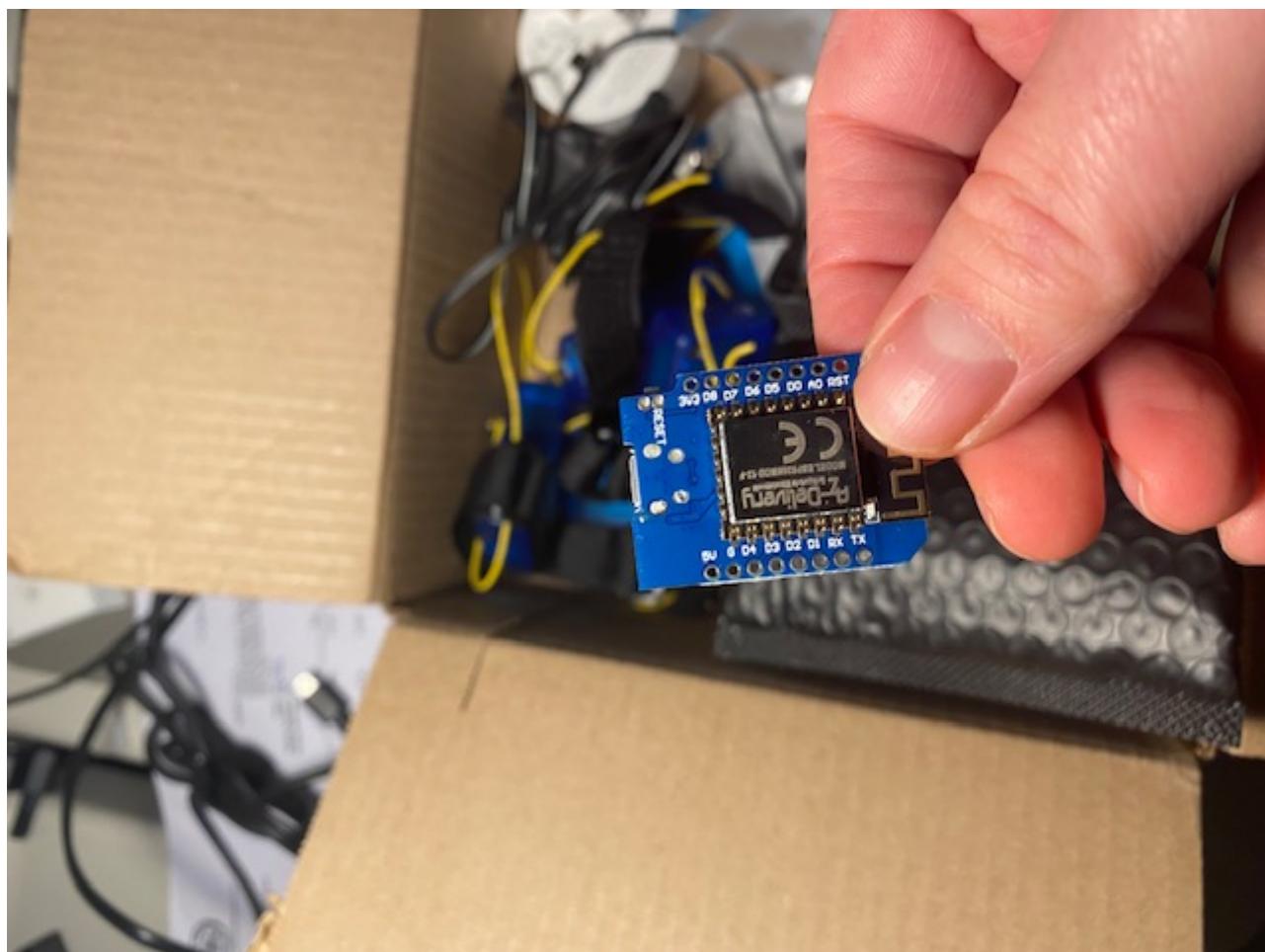
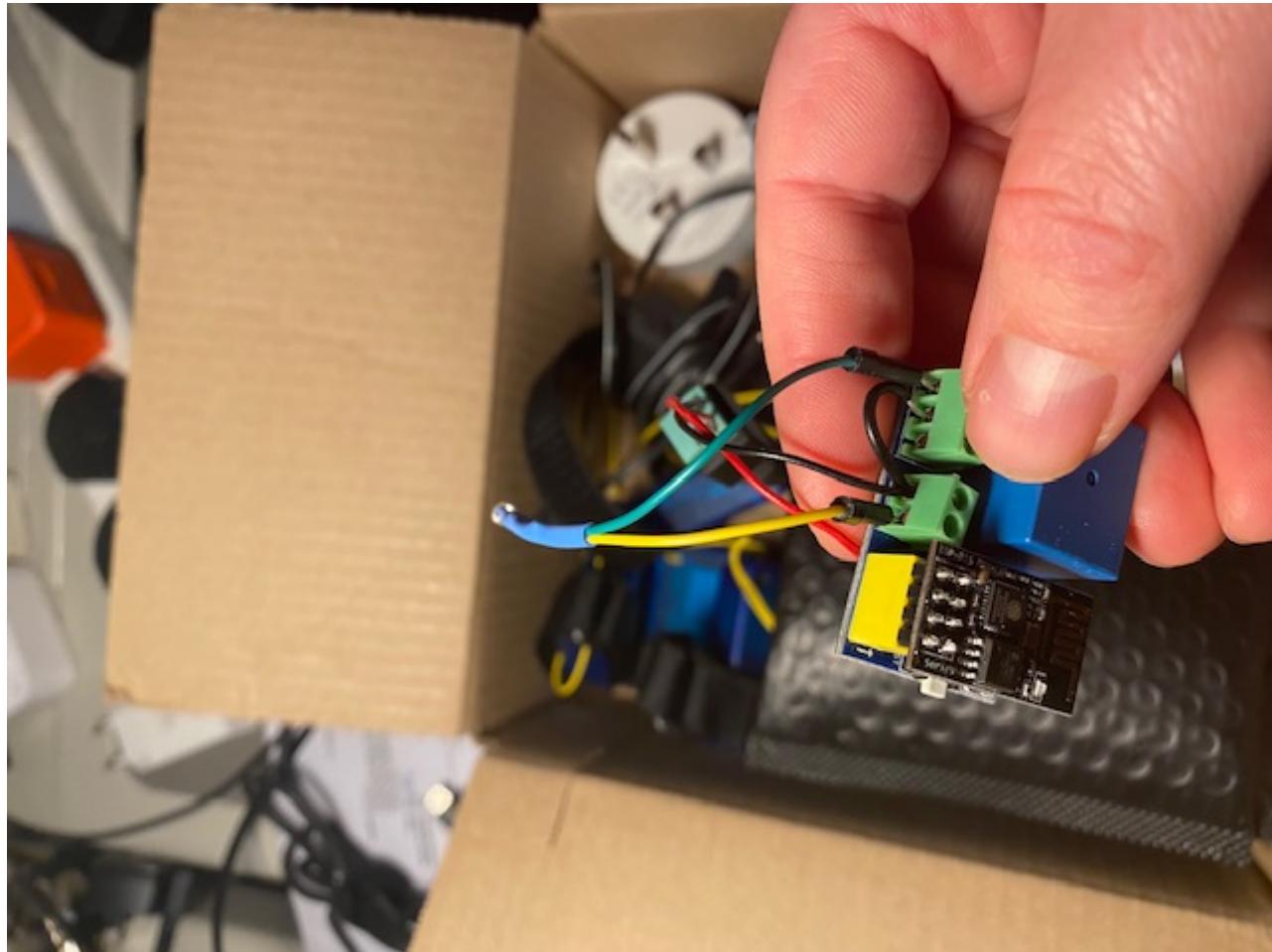
2. 4 x mains plug USB power supply.



3. 4 x USB power isolator.



4. 3 x sample SWITCH devices. (ESP-01 Relay, Sonoff Basic mains module, ESP8266 Wemos D1 Mini)





5. 2 x Android type micro-USB cable.

6. 1 x 6V DC plug power supply unit with male/female jack plug for ESP-01 relay module.



7. 1 off Tasmota compatible "Local Bytes" WiFi plug.



NOTE:

HUB #2 is pre-paired with the 3 sample SWITCH devices.

HUB #3 to #5 are NOT PAIRED.

Bringing up the System

1. Connect hub (e.g. Hub #2) to a USB plug via a USB power isolator.
2. Device will enter SETUP and all three LEDs will blink twice then the blue LED will turn on for ~ 3 seconds.
3. Device will then enter NORMAL mode - Blue LED will go out for ~ 6 seconds.
4. Then if main antenna is NOT deployed to a cable MAINS ON state MAY BE INDICATED!

Mains Detection

1. Deploy the HUB device with voltage detection wire wrapped 8 times around target cable.
2. Cable MUST be a single core wire with live only. (other configurations *might* work but may need an algorithm tweak)
3. Voltage detection wire should be wrapped as tightly as possible to the live cable, and the coils should not be spread out. The device can sit on top of the coils and be attached with the included velcro straps. For example this is a good installation:



Whereas this should be avoided:



4. While the target cable live core is at 220 V AC the blue mains status LED will be on mostly with blink to off.
5. While the cable live core is disconnected or at ~ 90 v AC the blue LED will be OFF mostly with blink to on.

IMPORTANT: The detector is tuned to work on a cable WITH A LIVE ONLY CORE.

Switch Devices

While the HUB is on it's paired SWITCH devices will indicate mains status with BLUE LED.

If a regular ESP-NOW messages is being received from the HUB short blinks indicate comms is good.

If the HUB is sending "MAIN IS ON" status the blue LED will be mostly ON with short blinks to OFF.

If the HUB is sending "MAIN IS OFF" status the blue LED will be mostly OFF with short blinks to ON.

If the SWITCH device does not receive an ESP-NOW message for a few seconds it will enter DISCON MODE.

In this case the blue LED will alternate SLOWLY between on and off.

The last state of mains status received from the HUB will be maintained until comms is re-established.

Pairing Mode: HUB

The HUB has a "PAIR" button which can invoke TWO options.

1. When pressed for a short time (more than half a second and less than 2 seconds) - "START PAIRING MODE".
2. If held for longer than two seconds an option to CLEAR PAIRED DEVICES starts.

In "PAIRING MODE" the blue LED flashes rapidly and the HUB waits for a request to pair from a SWITCH device.

If a successful pairing request is received the SWITCH device is added to the paired device list and the PAIRING MODE exits. If no request to pair is received the PAIRING MODE times out after 30 seconds.

When CLEAR PAIRED DEVICES is selected all three LEDs start to light in sequence. If the button is held until all three LEDs are ON the paired devices are cleared.

Pairing Mode: Switch Device

Pairing can be initiated in TWO ways depending on the device being paired.

For devices with a button connected to GPIO 0 this can be used to initiate pairing.

Available to ALL devices is a pairing mechanism during setup.

This involves resetting the device then waiting for the steady blue LED ON signal.

If the reset button is pressed again during this "pairing option" period this will set a flag in EEPROM.

At the end of the setup sequence instead of "NORMAL" mode the device will enter "PAIRING" mode.

In pairing mode the blue LED flashes rapidly and the device requests to be paired to the HUB.

If successful the SWITCH will reset. A limit of 30 seconds can elapse before pairing is aborted if unsuccessful.

Special Function HUB #5

Hub #5 is already specially paired with the Tasmota plug. When this device determines mains voltage is on, it will send a signal to the Tasmota device to switch power on. This is hardcoded behaviour on this device only, for prototype testing purposes.