W5300 IP 3D Camera over Single Pair Ethernet

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Introduction

Have you ever wanted to count the insects flying over the meadow? Or check if the bee house you have installed in your garden is inhabited?

I think that only a few people sit in the meadow and count insects. It is a pity because their population has been shrinking rapidly in recent years. A camera can do it for us, which will photograph and count all the creatures flying around it. A camera that not only sees a flat image, but also measures the distance and size of the object.

Hence the idea to experiment with ToF VL53L7CX sensors from ST and the W5300 chip from Wiznet. An idea I am submitting for the contest.

Objectives

1. The field of view of the camera forms a hemisphere.
2. The camera streams image and data over an IP network. For short distances on a traditional 4-wire UTP cable, for long distances on a single-pair cable.
3. The device can be powered remotely via PoE or locally with 5V or 24V.
4. The processing power of the processor is to be used as much as possible for calculations related to image handling and ToF sensors.

Specifications

1. The W5300 chip provides both PHY and MAC interface. Direct PHY for UTP cable, and via MII and the ADIN1100 chip PHY interface for Single Pair Ethernet (objective 2). It also includes a full TCP/IP stack, so there is no CPU overhead for Internet handling (objective 4).
2. The OV2640 camera module with a 180-degree wide-angle lens provides images in visible light (objective 1).
3. Seven VL53L7Cx sensors are needed to cover the hemisphere, as each sensor covers an area of 60 x 60 degrees (objective 1).
4. The STM32U575 microcontroller was used due to its high computing power and low power consumption, which facilitates remote power supply (objective 3).