Indoor Localization System Based On Visible Light Communication

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Overview
Visible light communication (VLC) has been proposed as a technique for indoor localization. Using LED for VLC can provide illumination while transmitting light signal. As long as the modulation frequency is sufficiently high and over the threshold of the human eye, people will not observe any flickering nearby.

CMOS Camera Properties
The majority of new-generation smartphones, like Android phones and iPhone have built-in complementary metal oxide semiconductor(CMOS) cameras providing the ability to capture photos and videos. Most CMOS sensors contain pixels that are arranged in sequential rows, like a scan line. As a result, the camera does not capture the entire image at one time.

Analysis
In order to capture meaningful image, underexposure picture will be taken, which will ignore most of background information and high shutter speed, only show the black string and white string on the light source.

In photography, Exposure Compensation is a technique for adjusting the exposure indicated by a photographic exposure meter, in consideration of factors that may cause the indicated exposure to result in a less-than-optimal image.

Obviously number of bits received is direct proportion to frequency, but limited by the size of the light source on the image. In addition, CMOS camera can receive the data package as high as 8k Hz and 4m.

Methodology...
By the characteristic of Rolling Shutter camera, the photo taken under the LED will be like a bar code. Go thought the grey scale filter and OTSU filter, the image can convert into 1D curve which similar to digital signal wave.

The data package was designed with a identify pattern and data bits. The identify pattern are designed with the most wide white bar, which can tell the begin of the data package and the bit width. However, avoiding bit width error detection, only the middle part of the image will be decoded.