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Visible Light Communication Using Sensors

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ABSTRACT: we propose different sensor system using visible light communication (VLC).It is considered as effective tool in future wireless communications technology.VLC is a secure communication compared with other wireless communications. Li Fi (Light Fidelity) is a fast and robust optical version of Wi-Fi the technology of which is based on VLC. In this paper VLC using three type sensors CMOS SENSOR, CCD IMAGE SENSOR And SOLAR CELL. Here, we propose a light encryption scheme using devices having light-emitting diode (LED) and receiver potion consider different sensors. In this technique using shutter effect that can increase data rate then speed is also increased this communication.

KEYWORDS: VLC, LiFi, CMOS, CCD, LED

I. INTRODUCTION

VLC is considered as an effective tool in future wireless communications technology. It is a secure communication when compared with other wireless communications .Visible light is only a small portion of the electromagnetic spectrum. VLC is used for Vehicle to vehicle communication, networking in indoor environments. LED are preferred sources for dual purpose of lighting and data communication. The main components of this system are a high brightness white LED. It can be switched on and off very quickly. It gives nice opportunities for transmitting data Li Fi is the future technology in wireless communication. It is a Visible Light Communications technology. That has running wireless communications to receive and transmitting data at very high speeds. CMOS CAMERA SENSOR has a data reception in a mobile phone using VLC. The camera of the smart phone is used as a receiver in order to capture the continuous changes in state on-off. Light are invisible to the human eye. The information is captured in camera in the form of light and dark bands. Which are then decoded by the smart phone and the received message is displayed. By exploiting the rolling shutter effect of CMOS sensors, a data rate much higher than the camera frame rate is achieved then speed is increased.
The CCD IMAGE SENSOR Main part of CCD camera is CCD image sensor CCD consists of very closely packed MOS capacitors formed by p substrate, SiO2 and metal gate which can store or transfer Analog Charge Signals .The CCD is composed of precisely positioned light sensitive semiconductor elements arranged as rows and columns. Each row in the array represents a single line in the resulting image. In SOLAR CELL downlink signal is transmitted by a white light LED lamp that can provide lighting, VLC and energy harvesting for mobile devices. The downlink is received by a solar cell. The uplink can be captured by a surveillance camera image sensor. Using the camera image sensor as a VLC receiver is challenging since the data rate is limited by the frame rate and due to uneven light exposure. The rolling shutter effect of the image sensor can be used to increase the data rate.

VISIBLE LIGHT COMMUNICATION (VLC)

It is considered as an effective tool in future wireless communications technology. VLC is a secure communication when compared with other wireless communications .Visible light is only a small portion of the electromagnetic spectrum. Li Fi is a Visible Light Communications technology. That has running wireless communications to receive and transmitting data at very high speeds. The main components of this system are a high brightness white LED. There are preferred sources for dual purpose of lighting and data communication.

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It can be switched on and off very quickly, which gives nice opportunities for transmitting data.

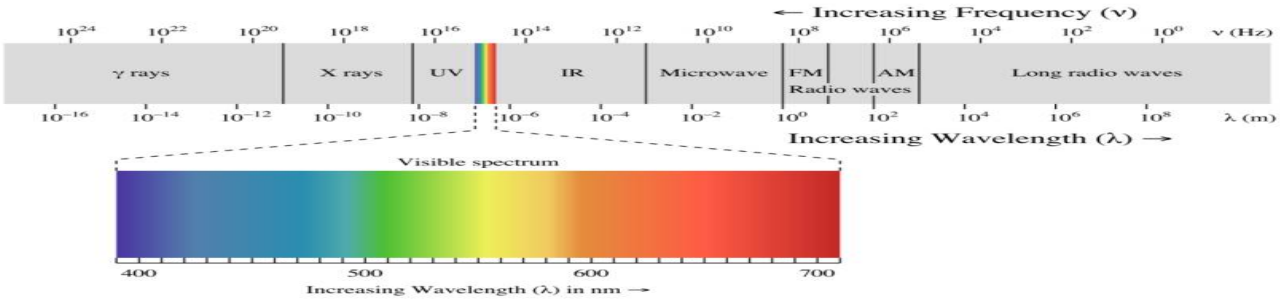

Fig: 1 Electromagnetic spectrum

Li Fi: THE FUTURE TECHNOLOGY IN WIRELESS COMMUNICATION

Wi-Fi is great for general wireless coverage within a building, where as Li Fi ideal for high density wireless data coverage in confined area. Li-Fi provides better bandwidth, efficiency and security than Wi-Fi.

Fig: 2 Light emitting diodes (LED)

II. LITERATURE SURVEY

a) CMOS CAMERA SENSOR

In this scheme for data reception in a mobile phone using VLC .The majority of new generation smart phones have built-in Complementary Metal Oxide Semiconductor (CMOS) cameras providing the ability to capture photos and videos. Which are then decoded by the smart phone and the received message is displayed. The rolling shutter effect of CMOS sensors, data rate much higher. Mobile phones with embedded cameras have become common. The majority of new generation smart phones have built-in CMOS cameras providing the ability to capture photos and videos.

Fig: 3 Light encryption for a mobile phone

This is the light encryption for a mobile phone, here a led and light encrypter are in encryption potion. Two users are there user one and user two user one have right key so decryption done and user two have no right key so cannot done

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decryption. The transmission of data from an LED to a smart phone using the built-in camera a receiver. The model (Fig 4) involves the transmitter protocol and an Android application for the signal reception and decoding at the smart phone. Using this model, data can be transferred to a mobile device.
This is the System block diagram of visible light communication using CMOS sensor. The upper part shows the transmitter which Consists of an On-Off Keying driver, and an LED and the lower part shows the receiver mobile phone. In Transmitter side An LED, connected to a simple on-off keying (OOK) transistor switch circuit, is used as a transmitter

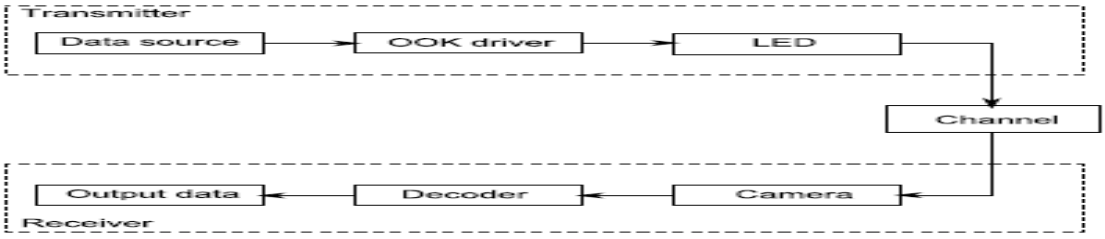

Fig:4 System block diagram of visible light communication

The encoding procedure at the transmitter is as follows And Receiver side the light from the transmitter is used to illuminate a surface and the reflection is received by the camera of the Smartphone. The preview mode of the camera is used to capture a continuous array of frames and then, a decoder based on Java is applied frame by frame.
The rolling shutter mechanism is a method of image acquisition used by CMOS sensor cameras. The sensor operation is shown in Fig. 5 CMOS pixel converts incident photons into electrons which are then converted to a voltage, from which the pixel value is obtained. The level of signal generated by the image sensor depends on the amount of light incident on the imager, in terms of both intensity and duration. Most CMOS sensors contain pixel that are arranged in sequentially activated rows (scan lines) and therefore do not capture the entire image at once. On activation, each scan line of the sensor array is exposed, sampled and stored sequentially When this procedure is completed the scan lines are merged together in order to form a single image.

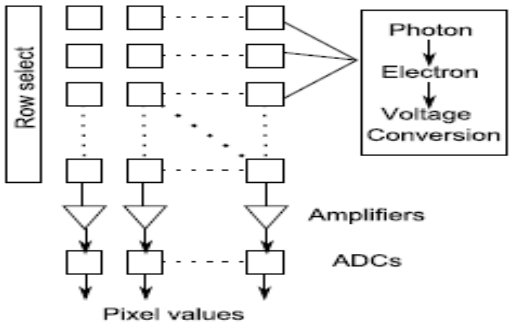

Fig:5The CMOS sensor operation

ROLLING SHUTTER

Rolling shutter is the term used to describe this process. Fig.6 shows the procedure of capturing the lines of the image one at a time. Various effects can be observed due to the rolling shutter operation such as skew seen in images of a moving object. While this may seem undesirable, this property of the CMOS cameras can actually be utilized in optical wireless communication In order to transmit data from an LED to a mobile phone. When the flashing frequency of the LED is lower than The rolling shutter's scanning frequency but higher than the frequency of the preview display of the camera and (frames per second or fps), bands of different light intensity appear in the image. When the LED is on, the camera sees a bright frame and the CMOS sensor exposes one array of this image, which is shown in Fig. 6, as the first

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white line in the image. The transmitter then changes to the off state and the second scan line is enabled, which results in the first black line in the image. This procedure continues until all the scan lines are exposed and the image is completed. acquisition used by CMOS sensor cameras Fig. 6 Rolling shutter operation: The top squares indicate the state of the LED light. The bottom squares show the output of the CMOS camera as it enables one scan line at a time, forming the final image.

Main part of CCD camera is CCD image sensor CCD consists of very closely packed MOS capacitors formed by p substrate, SiO2 and metal gate which can store

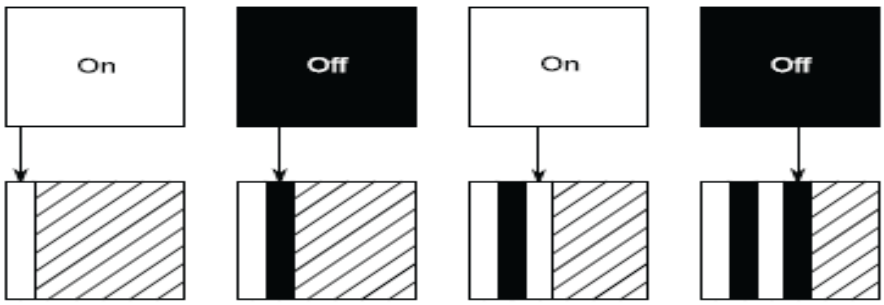

Fig:6Rolling shutter mechanism is a method

or transfer Analog Charge Signals The CCD is composed of precisely positioned light sensitive semiconductor elements arranged as rows and columns. Each row in the array represents a single line in the resulting image.

b) CCD IMAGE SENSOR

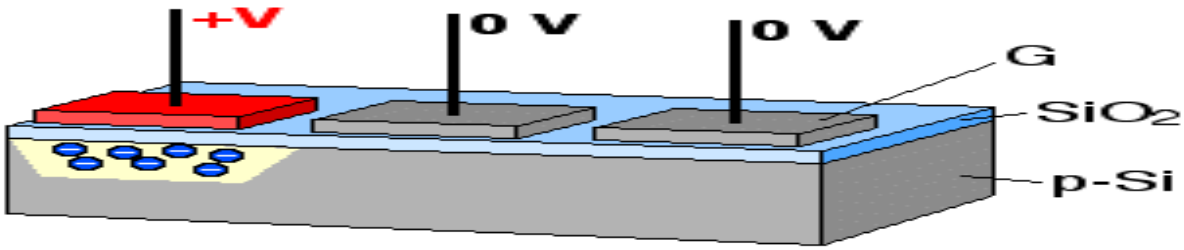

Fig: 7 light sensitive semiconductor elements arranged as rows and columns

WORKING

The Application positive potential to the gate results the development of depletion regions (potential well) just below them. When any image is focused onto the Si chip electrons are generated within it. The number of electrons depends on the intensity of incident light and hence the depth varies according to the applied voltage Once produced they collect in the nearby potential wells. In this section electrons and coming to silicon and charge will produce then move through depletion region, when charge accumulation when the exploring time. This is the pixel arrangement of photo sensors, the sensors will arrange vertical shift register and horizontal shift register. registers is clocked out is governed by the number of elements camera complies with (pixels) per row and the video standard the. CCD image scanning is the interlaced scanning in cameras the charge transfer to the vertical shift registers is accomplished in two stages the odd numbered rows followed by the even rows

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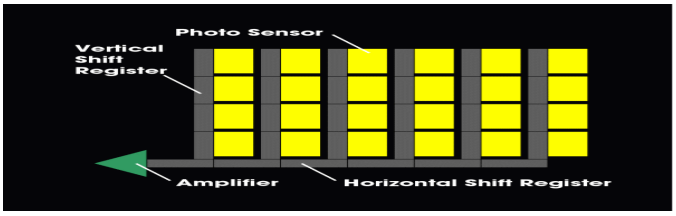

Fig: 8 The pixel arrangement of photo sensors

Next the charges in the vertical er and clocked to the CCD output. All the odd rows are clocked out first (odd field) followed by all the even rows (even field). The rate at which the charge from the horizontal shift

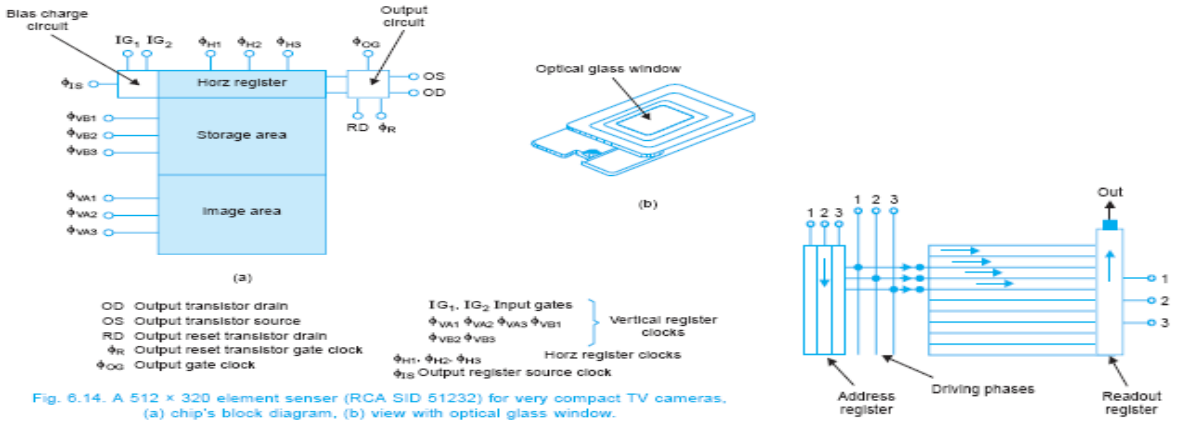

Fig. 6.14. A 512 × 320 element senser (RCA SID 51232) for very compact TV cameras, (a) chip's block diagram, (b) view with optical glass window.

Fig:9

CCD image scanning

c) SOLAR CELL

An electronic label and sensor system using visible light communication (VLC). The downlink signal is transmitted by a white light light emitting diode LED) lamp that can provide lighting, VLC, and energy harvesting for mobile devices. The downlink is received by a solar cell. The uplink can be captured by a surveillance camera image sensor. However, using the camera image sensor as a VLC receiver (Rx) is challenging since the data rate is limited by the frame rate and due to uneven light exposure. The rolling shutter effect of the image sensor can be used to increase the data rate. In this demonstrate how to demodulate the obtained rolling shutter pattern using a second-order polynomial (SOP) extinction ratio (ER) enhancement scheme, together with iterative and modified quick adaptive thresholding schemes. The ER enhancement scheme can significantly reduce the large ER fluctuation. Experimental results show that by using the proposed SOP ER enhancement scheme, the bit error rate (BER) improvement can be up to two orders of magnitude. Also believe that the proposed electronic label and sensor system may be applicable to Internet of Things sensing networks for connecting a number of mobile devices.

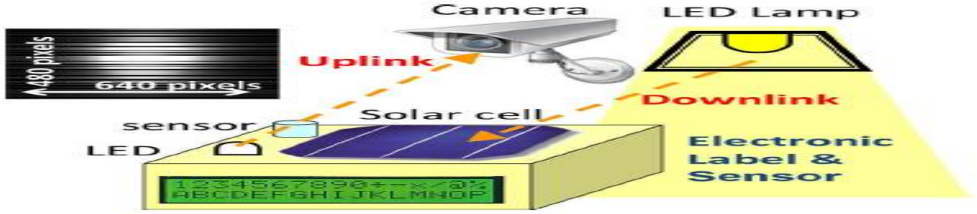

Fig:10 An electronic label and sensor system using visible light communication.

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The downlink signal is transmitted by a white-light LED lamp that can provide lighting, VLC and energy harvesting for mobile devices. The downlink is received by a solar cell. The uplink can be captured by a surveillance camera image sensor. Using the camera image sensor as a VLC receiver is challenging since the data rate is limited by the frame rate and due to uneven light exposure. The rolling shutter effect of the image sensor can be used to increase the data rate. Fig.11 (a) shows electronic label and sensor system, The mobile device can have different kinds of sensors, such as for temperature or humility sensing. The display in the mobile device can show the environmental parameters, or the price of commodities if used in department store. The environmental parameters or monitoring information are sent back to the CO as uplink signal. This uplink signal can be captured by a surveillance camera image sensor. It can be a point to multiple points (multiple devices) system since the surveillance camera will scan over the entire area and receive uplink signals from many devices using Time division multiple access (TDMA). Fig. 11(b) Shows the mechanism of rolling shutter effect of the CMOS image sensor. An electronic label and sensor system using VLC. Here, we also proposed and demonstrated a SOP ER enhancement scheme together with two thresholding schemes (iterative and modified quick adaptive schemes) for demodulation of the rolling shutter pattern.

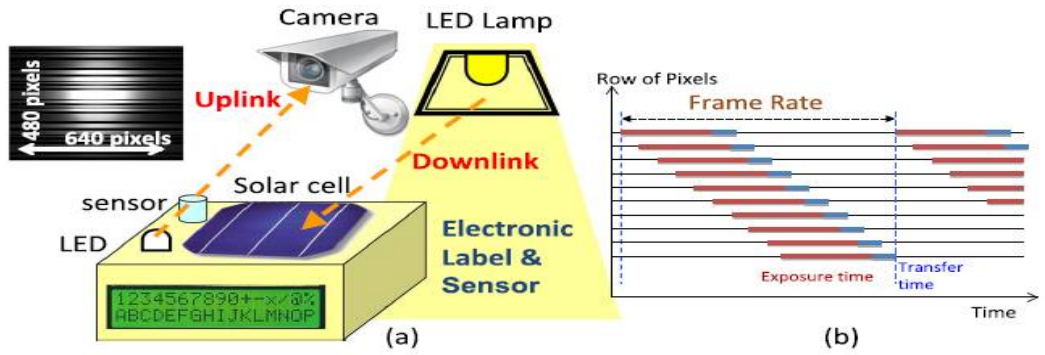

Fig: 11(a) shows electronic label and sensor system, b) Shows the mechanism of rolling shutter effect of the CMOS image sensor.

Experimental results showed that the SOP ER enhancement scheme can significantly enhance the BER performance; and the modified quick adaptive scheme outperformed the iterative scheme. On the other hand, BER of the downlink signal emitted by a white LED and received by a solar cell panel was performed.
In this graph shows experimental gray scale values.fig:12 (a) Before, (b) after applying the SOP ER enhancement. SOP ER enhancement scheme together with two threshold schemes (iterative and modified quick adaptive schemes) for demodulation of the rolling shutter pattern. Experimental results showed that the SOP ER enhancement scheme can significantly enhance the BER performance; and the modified quick adaptive scheme outperformed the iterative scheme. On the other hand, BER of the downlink signal emitted by a white LED and received by a solar cell panel was performed.

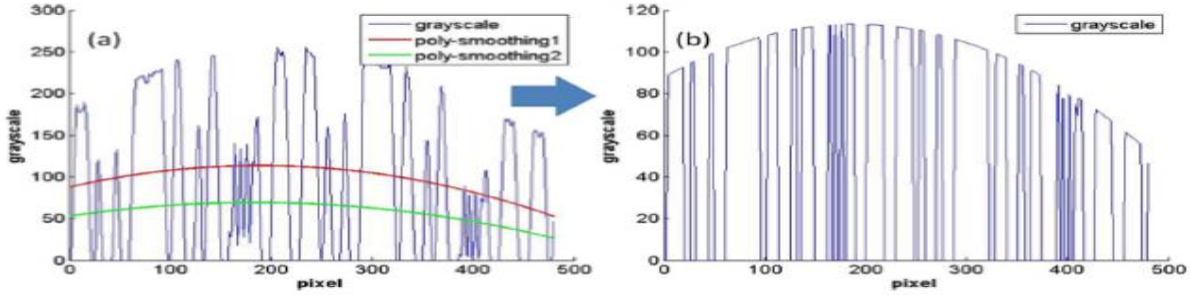

Fig:12 Graph shows experimental gray scale values. (a) Before, (b) after applying the SOP ER enhancement

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III. COMPARISON

In three types of sensors are using to encrypted data .that can be used in receiver portion of communication system. photodector are usually used the receiver in this visible light communication but here using sensors that are to be much better than other techniques in cmos camera sensor are used to In this scheme for data reception in a mobile phone using VLC.The majority of new generation smart phones have built-in Complementary Metal Oxide Semiconductor cameras providing the ability to capture photos and videos. Which are then decoded by the smart phone and the received message is displayed. The rolling shutter effect of CMOS sensors, data rate much higher. Mobile phones with embedded cameras have become common. Rolling shutter effect has data rate is increased and also increased speed but expensive is high. Only indoor communication is done.Pixel size is increased than can provide less power consumptions in CMOS camera sensor have less pixel size so power consumption is high.

Different types of sensors	**shutter effect**	**Acquire Images Differently**	**Pixel size**
CMOS SENSOR	Rolling Shutter	CMOScollects and reads out oneline at a time	1.74 micron
CCD IMAGE SENSOR	Global Shutter	CCD collects an entire frame at once.	9 x 9 micron
SOLAR CELL	Rolling Shutter	Solar cell collect in image at beam	800 × 600 micron

In this sensor has Acquire Images is CMOS collects and reads out one line at a time. Next sensor is CCD image sensor Main part of CCD camera is CCD image sensor CCD consists of very closely packed MOS capacitors formed by p substrate, SiO2 and metal gate which can store or transfer Analog Charge Signals The CCD is composed of precisely positioned light sensitive semiconductor elements arranged as rows and columns. Each row in the array represents a single line in the resulting image. In this sensor shutter effect is global shutter effect, data rate is minimum compared to CMOS and SOLAR cell. Acquire Images in CCD camera sensor is collects an entire frame Once. Pixel size is 9*9 micron that is providing minimum level power consumption. Last one is Solar cell an electronic label and sensor system using visible light communication (VLC). The downlink signal is transmitted by a white-light light-emitting diode (LED) lamp that can provide lighting, VLC, and energy harvesting for mobile devices. The downlink is received by a solar cell. The uplink can be captured by a surveillance camera image sensor. However, using the camera image sensor as a VLC receiver (Rx) is challenging since the data rate is limited by the frame rate and due to uneven light exposure. The rolling shutter effect of the image sensor can be used to increase the data rate. Rolling shutter effect are using so data rate and speed increased .Acquire image is collect in image at beam. Pixel size is more than compared to other sensors here pixel rate is 800*600 micron, so power consumption is low. This is the over view of three sensors comparative study .

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CMOS SENSOR	SOLAR CELL
HIGH COST	LOW COST
LOW SPEED	HIGH SPEED
SPACE AND TIME MODULATION OCCUR	SPACE AND TIME MODULATION NOT OCCUR
INDOOR	OUTDOOR
MORE NOISE RESISTANCE	LESS NOISE RESISTANCE

Here we taken CMOS sensor and SOLAR cell these two are same to same level .so here again classified into SOLAR cell And CMOS camera sensor.In receiver portion of visible light communication is using photo detector but here get a new idea that is sensors using visible light communication receiver portion. Three sensors are compared there and we get solar cell is the best sensor system than compared with other two sensor system. Because it is less expensive and more speed than others.

IV. CONCLUSION

In this paper the potential of using visible light communication for data transmission to a mobile phone is investigated. A system, consisting of an LED transmitter and the mobile phone camera as a receiver, is presented. A proof-of-concept has been established, demonstrating that the rolling shutter effect can be constructively exploited to achieve data rates multiple times faster than the frame rate using an embedded CMOS camera sensor. As far as future work is concerned, in order to increase the data rate VLC is regarded as a relatively secure communication when compared with other wireless communications. Here, we proposed a light encryption scheme. We proposed an electronic label and sensor system using VLC. Experimental results show that the solar cell is good .In VLC using three sensors the solar cell is Better than other sensors .in this generation speed of data rate is most important factor solar cell is high speed provide it is less expensive.

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