REAL TIME VIDEO STREAMING USING ARM FOR DEFENCE APPLICATION

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ABSTRACT

The paper provides the system for video streaming in ISM band which make the system low power and low cost for defence application which was limited by the wireless sensor networks (WSN). Video streaming is done by capturing images continuously and displaying them that looks like a video. The use of Zigbee was not sufficient to transmit data over limited bandwidth. Further traffic is introduced while transmitting JPEG images over Zigbee channel due to its controlled bandwidth. Hence this paper provides a solution that captures images using Vision sensor and transmit over Xbee transceiver that can be deployed in highly sensitive area for defence control. ARM (Advanced RISC Machine) microcontroller is used to read the images captured by the vision sensor.

Keywords -- Wireless Sensor Networks, Video Processing, ARM, Motion Detection, Image Transmission

1. INTRODUCTION

Wireless sensor networks (WSNs) have been the field of interest in recent years. WSN is applied to multiple fields such as video surveillance, home automation, and health care. Video streaming in wireless networks is a promising and difficult application where the purpose of video streaming becomes important for security systems and surveillance systems. The prime component of the system is the Passive InfraRed sensor (PIR) that detects the movement and activates the rest of the system. This part of power consumption is imparted. Then the Vision sensor (OV7725) captures the images. The captured pictures are read by the ARM microcontroller (ARM LPC2148) which is capable of transmitting it to receiver with the help of a suitable transceiver device like XBee 2.4GHz(ISM). Other than the vision sensor should be in sleep mode.

2. COMPONENTS

- Passive Infrared Sensor
- ARM LPC2148
- XBee
- Vision Sensor (OV7725)
- MAX232
- Power supply unit
- PC Softwar

2.1 PIR sensor

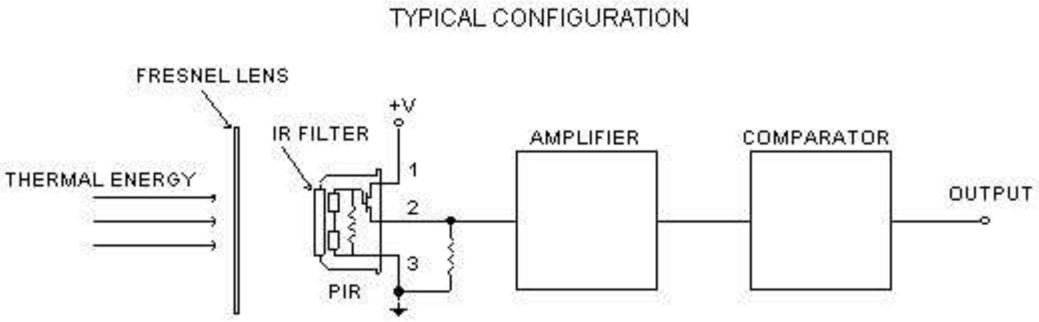

Fig PIR Motion Sensor Components

This project uses compact and complete, easy to use Passive Infrared (PIR) Sensor Module for human body detection, by incorporating a Fresnel lens and motion detection circuit. It has high sensitivity and low noise. Output is a standard TTL active low signal indicated by on board LED. The PIR (Passive Infra-Red) Sensor is a piezoelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. The motion can be detected by checking for high signal on an I/O pin. PIR sensor detects changes in the amount of infrared radiation which varies depending on the temperature and surface characteristics of the objects in front of the sensor.

2.2 ARM LPC2148

ARM LPC2148 is 16-bit/32-bit ARM7TDMI-S microcontroller in a tiny LQFP64 package. It has 40 kB of on-chip static RAM and 512 kB of on-chip flash memory, In-System Programming/In-Application Programming (ISP/IAP) via on-chip boot loader software, USB 2.0 Full-speed compliant device controller with 2 kB of endpoint RAM, Two 10-bit ADCs provide a total of 14 analog inputs.

2.3 XBee

XBee is a specification for high level communication protocols using small and low-power digital radios based on an IEEE 802.15.4 standard for personal area networks (PAN). XBee is targeted at radio-frequency (RF) applications that require a low data rate, long battery life, and secure networking. XBee is designed to provide highly efficient connectivity between small packet devices. XBee. Xbee has security aspects and advantages over other protocols and hence it best suites for our purposes.

Fig XBee module

2.4 Vision Sensor

The 0.3M Pixel Serial JPEG Camera module has a compact size, low power consumption, and stable operation. 5.0V DC Supply. UART: Up to 115200bps for transferring JPEG images. The camera uses the advanced Omni Vision OV7725 VGA color sensor JPEG CODEC for different resolutions. This device has an image array capable of operating at 60 frames per second in VGA with complete user control over image quality, formatting and output data transfer. All required image processing functions including exposure control, gamma, white balance etc are also programmable through the SCCB interface.

Fig Omni Vision sensor

2.5 Max232

The MAX232 is an IC that converts signals from an RS 232 serial port to signals suitable for use in TTL compatible digital logic circuits. The MAX232 is a dual driver/receiver that includes a capacitive voltage generator to supply TIA/EIA-232-F voltage levels from a single 5V supply used for TX and RX signals, and the second one for CTS and RTS signals.

2.6 Power supply unit

The power supply unit provides 5 V, 500mA output to drive the nodes. The AC voltage at 220V is stepped down to 20V using a 220/20V steps down transformer. This AC voltage at 20V is fed to rectifier that converts it to DC voltage.

2.7 PC Software

MatLab GUI for PC is required to convert the received images into a matrix of pixel values that can be transmitted easily without image collapsing. High level language C is used in programming. IDE used is Proteus.

3. IMAGE TRANSMISSION OVER XBEE

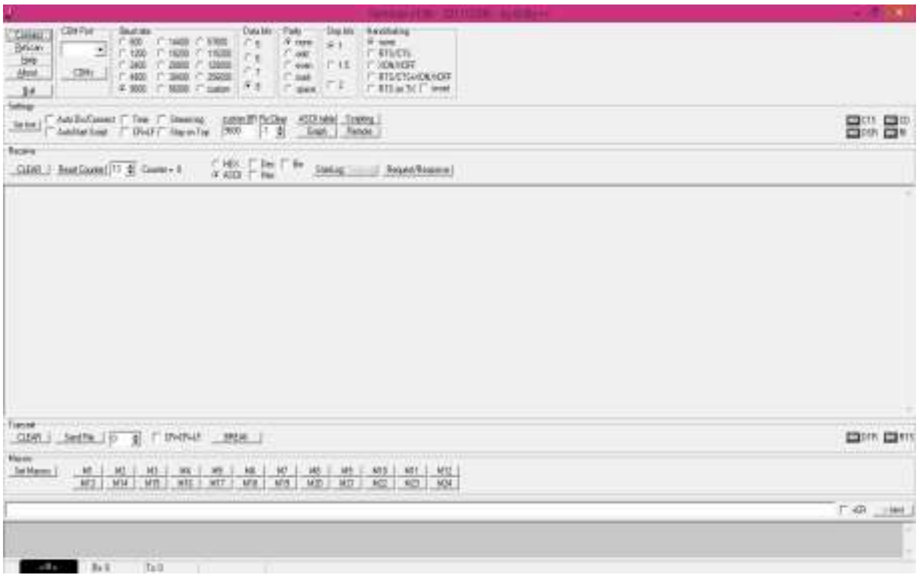

Fig Terminal-PC

The image is taken and it is broken into numbers containing intensity values of each pixel and converted into the matrix on the transmitter side. On the receiver side the matrix is reconstructed into the image. To perform the serial transmission of an image, each colour disintegrate of the image is separated as a matrix and it is stored as a vector and it also converted into the text file for transmission through XBee. All three colour channel models are separated from a colour image and stored as an individual text file. Each file is transmitted separately through XBee. The XBee is connected to the supply and is set up for transmission by interfacing it to the COM ports of the transmitter and receiver systems. On reception, the values of the text files are vertices number so it could be converted as a matrix values so the inverse operation of conversion is performed i.e. vector to matrix conversion.

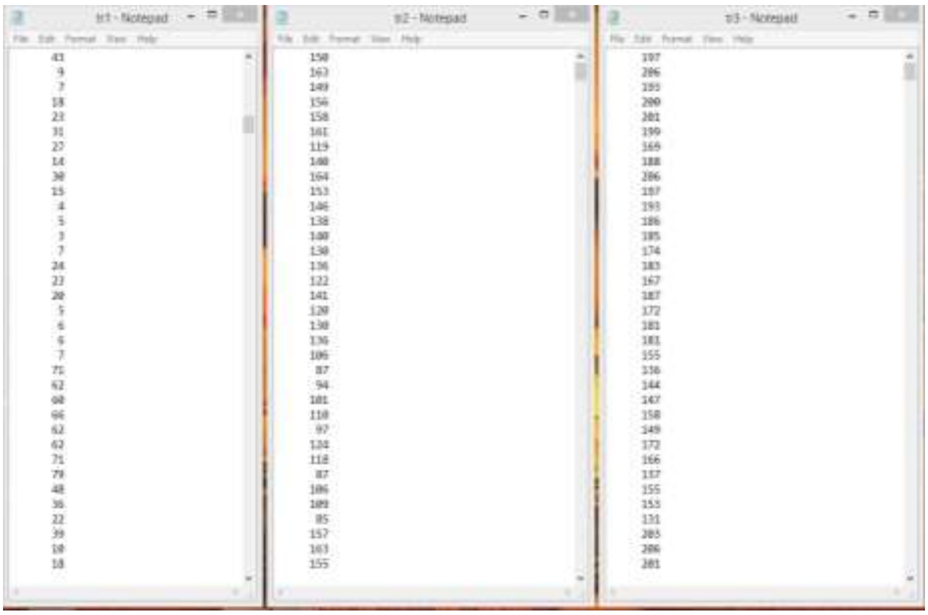

Fig. Intensity values of different colour channels as text files

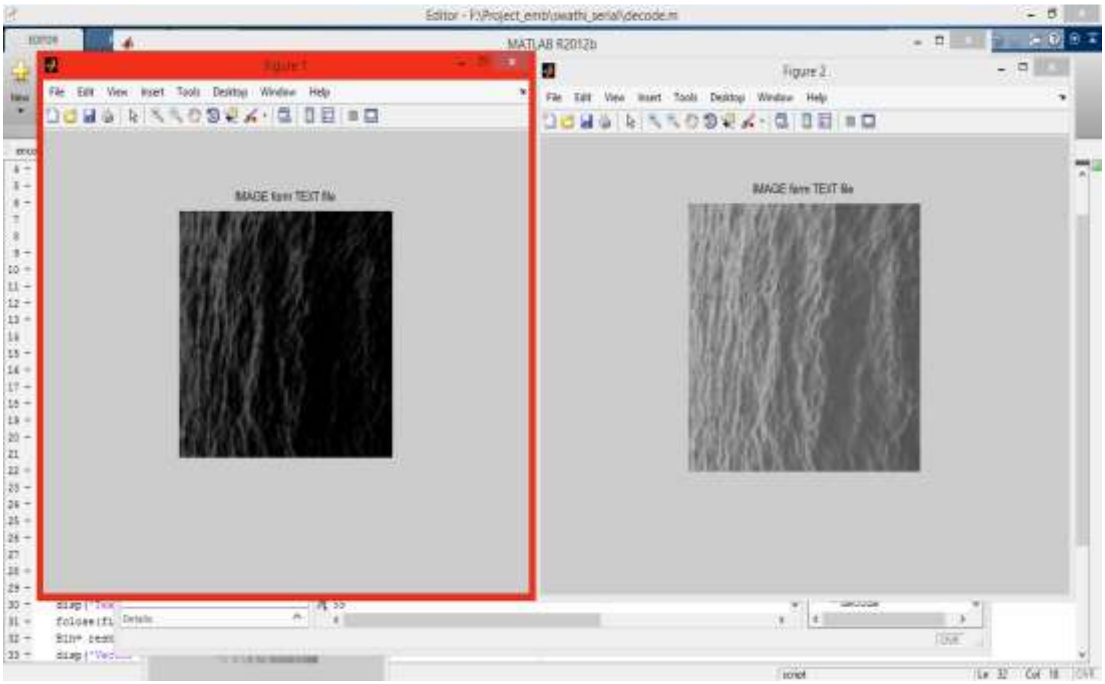

Fig Red and Green colour channels

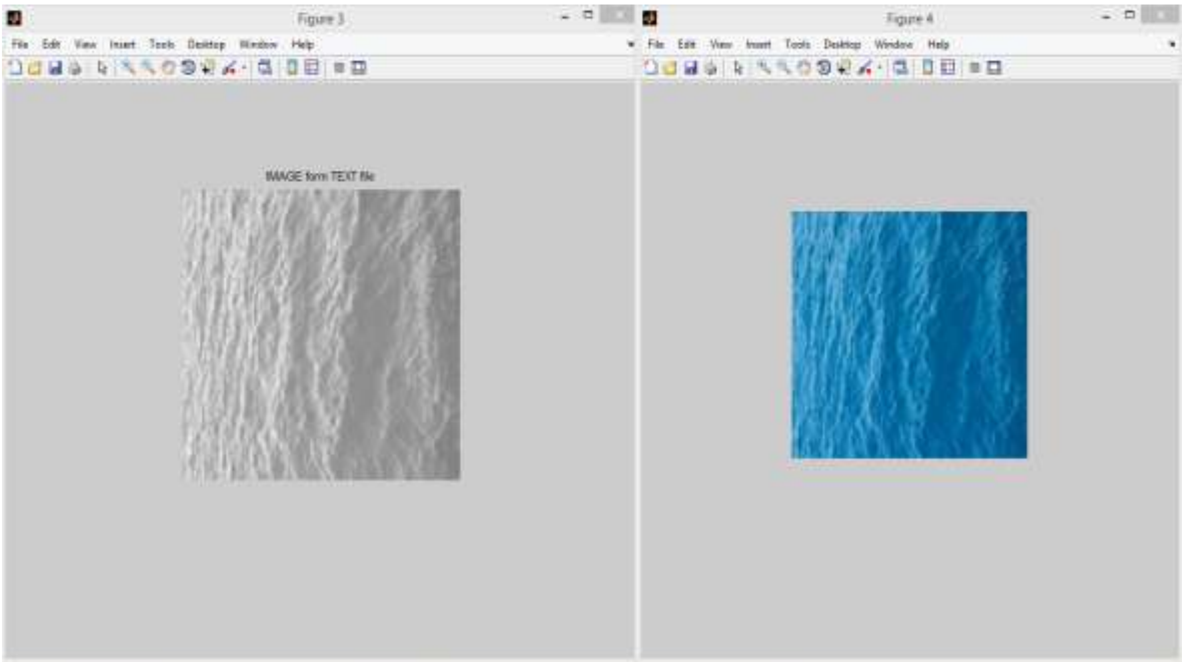

Fig Blue channel and concatenated image

4. RESULTS AND DISCUSSION

Upon transmitting the images at a continuous rate, the video could be observed at the receiver end. This system transmits images are transmitted at a rate of 75-85 images per second that looks like a video on the receiver side.

5. FUTURE WORK

The further experiments are to be made to improve the speed of transmission and the distance over which it is transmitted. Increasing the speed of transmission, the seamless video can be observed at the receiver end. In addition, the PIR motion sensor can be included to reduce the overall power consumed by the system. Further improvements can be done to increase the resolution of the video.

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