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Real-Time Video Streaming Over Bluetooth Network Between Two Mobile Nodes

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Abstract

The Bluetooth arrangement provides a very robust and powerful technology within a short range wireless communication. The communication over Bluetooth is complicated with a heavy security threat. Here, in this paper we proposed for a system, Bluetooth Enabled surveillance System (BESS) that will help transmitting live video streaming in between two mobile phone via built-in cell phone camera. This system can be useful for surveillance of a secret area or monitoring of any important work. This system can help to prevent certain attack within a small range.

1. Introduction

The Bluetooth [2] network is used to connect mobile nodes and other pervasive devices over the ISM band at 2.420-2.485GHz, using a spread spectrum, frequency hopping, full-duplex signal at a nominal rate of 1600 hops/sec. The large scale use of Bluetooth technology and mobile devices has generated to provide the services which are currently available in wired network [1]. Another important thing is power optimization [4] which will discuss later in this paper. Mobile phones are very important and useful gadget and most of them have camera using this feature our proposed plan will succeed. The video data transfer from one mobile node to other is very difficult to implement. The video data input, accepted through one mobile camera will be converted into byte stream and is directed in the output stream using Bluetooth link. In the other side, mobile node which is now ready to accept the byte stream will accept the input stream. The accepted byte stream will be now redirected to video format. Video over wireless communication (VoW) provides access to streaming video and supports various types of critical application. The VoW technology serves two main purposes, surveillance and monitoring. In the Bluetooth Version 1.1, there is no facility provided regarding video transmission. However, in enabling VoW to the end-user level, especially home appliances, mobile phones there is still no standard defined. Although there are some Audio/Video protocols specified after exploration of version 1.1, they are not finalized and the latest Bluetooth version Bluetooth 2.0+EDR [3] only offers a significant speed bump over its predecessor. This opens an opportunity for research into this field. The video data streaming is tedious, but not so difficult.

2. The Architecture for Bluetooth

Bluetooth is based on IEEE802.11 standard. Bluetooth is a low cost, low power radio technology operating in the ISM band. It consists of multiple mobile nodes which maintain network connectivity through wireless communication link. The Bluetooth architecture is so flexible to use with low overhead. The Bluetooth network is dynamic and completely deployable. Bluetooth technology employs frequency hopping, to allow for concurrent Bluetooth communications within radio range of each other without perceptible interference. The Bluetooth technology supports mainly three types of connection pattern for forming ad-hoc networks: point-to-point, piconet, scatternet. The point-to-point

communication enables two nodes to communicate with each other in some standard fashion. The piconet is actually point-to-multipoint communication. In the piconet, there is a master and seven slaves are there to serve. The Scatternet is more difficult to implement. In a scatternet one of the nodes from a piconet can participate to other piconet as a slave or a master. This is possible using TDM technique. Most Bluetooth devices are available in USB and UART dongles, or PC card for PCMCIA interface.

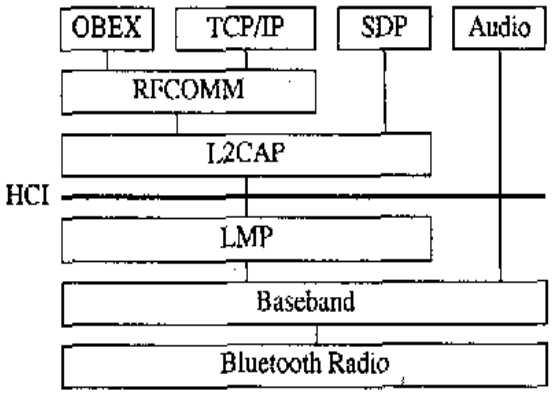

Fig.1 Protocol Stack for Bluetooth

The specification for BT Radio layer is primarily concerned with the design of Bluetooth transceivers.
The baseband layer defines how Bluetooth devices search for and connect to other devices. The baseband layer supports two types of links: Synchronous Connection Oriented (SCO) and Asynchronous Connection-less (ACL). The Link manager layer implements the Link Manager Protocol (LMP), which manages the properties of air-interface link between devices.
The LMP manages bandwidth allocation for all general data. The Logical Link Control and Adaptation protocol layer provides the interface between the higher-layer protocol and lower-layer transport protocols. The L2CAP supports multiplexing of several higher-layer protocols. This allows multiple protocols and applications to share the air-interface. It is also responsible for packet segmentation and reassembly. The Host Control Interface (HCI) layer defines a standard interface for upper-level application to access lower layers of the stack. Its purpose is to enable interoperability among devices and the use of existing higher-level protocols and applications.

3. Acquiring video data

Traditional video streaming over wired/wireless networks typically has band-width, delay and loss-requirements due to its real time nature.

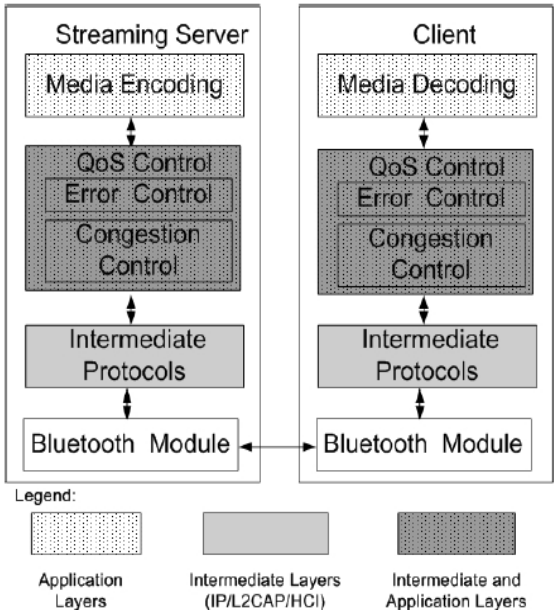

Fig. 2 Architecture for video streaming over Bluetooth

Moreover, there are many potential reasons including time-varying features, out-of-range devices and interference with other external devices that make bluetooth links more challenging for video streaming.

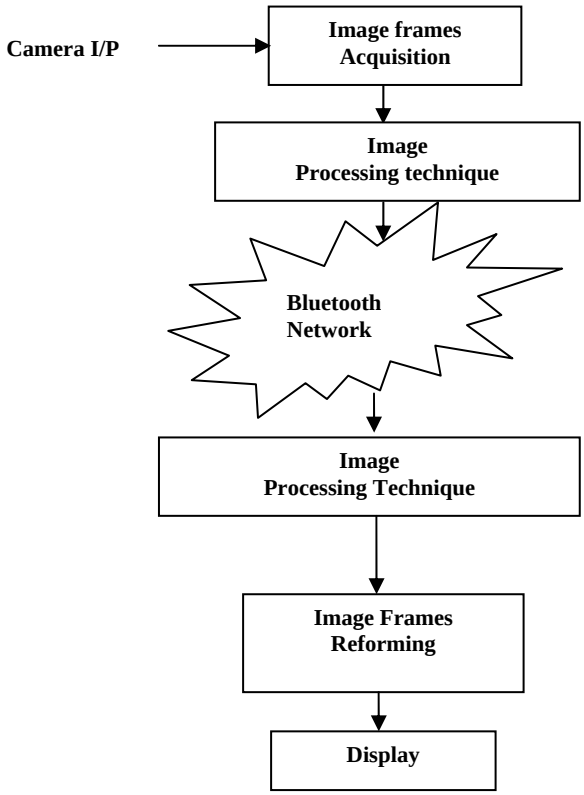

Fig. 3 video streaming using Bluetooth

Our proposed system (BESS) will acquire video image through mobile camera and will process the video data through several steps. Our system will be available in a single chip. It will operate in two modes: the master mode and the other is slave mode. This will act as a sender as well as receiver. The mobile phones which are going to be used for secret surveillance have to deploy this pre-programmed BESS chip in both senders end as well as receiver end. At the sender's end the BESS master mode should be enabled. It is now capable of transmitting continuous video data. The data must be compressed before the transmission starts. The aim of video compression is to remove redundant information from a digitized video sequence. The compressed video streams are partitioned into packets of the chosen intermediate layer (for example, L2CAP, HCI, IP, see fig. 2, where packets are packetized and segmented).

Now it is ready for sending segmented packets to Bluetooth module for transmission. On the receiving end the media packets are received from air and are reassembled. After these steps they are decompressed. The image frames will be reformed and at the receiving end one can see the reorganized video stream.

The power consumption is optimized here using low power dissipation. The duration of data transfer may vary depending upon situation. But there is a constraint in our proposed system that it can continue up to 2 -3 hours.

4. Conclusions

In this paper we proposed for a system which is capable of compressing and streaming of live videos over Bluetooth network. Three major aspects are to be taken into consideration namely video compression, Quality of Service (QoS) control and intermediate protocols. Video compression is to remove redundancy to achieve efficiency in a limited bandwidth network. QoS includes congestion control and error control. It is to check packet loss, reduce delay and improving video quality. It will give an enormous benefit in the area of surveillance work.

These are not a new problem but this approach is very much identical in pragmatic scenario.

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