Compression And Difference Transmission Of Acquired Image In Wireless Sensor Networks

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***Abstract*— Wireless Sensor Networks(WSN),which allows fine-grained monitoring of the environment is discussed. However, as sensors have physical limitations in energy, processing power, and memory, etc. techniques have to be developed to efficiently utilize the limited resource available in a sensor network. The image transmission problem in sensor networks is studied. A program based on compression and difference transmission for image acquisition in wireless sensor networks has been proposed in this article. Node captures image and compresses the image in the format of JPEG, while based on the time redundancy of images at fixed point, eliminates the correlation between collected image and reference image using difference algorithm, and then the extracted variation will be filtered by threshold, the result is called difference which is the final data carried out in the network, the gateway node or remote server reconstructs image according to the information received and reference image. Simulation results show that when we collect image in wireless sensor networks, the program can significantly reduce the amount of data, save network resources, thus the lifetime of network can be prolonged.**

Keywords*— *Image, Camera, Wireless sensor networks, JPEG Compression, Image transmission, energy conservation.

I. INTRODUCTION

A wireless sensor network is a network consisting of thousands of sensors that span a large geographical region. These sensors are able to communicate with each other to collaboratively detect objects, collect information, and transmit messages. Sensor networks have become an important technology especially for environmental monitoring, military applications, disaster management, etc. [1] [2].
However, as sensors are usually small in size, they have many physical limitations. For example, due to its limited size, a sensor does not have a very powerful CPU and is limited in computational power and memory. On the other hand, a sensor is powered by a battery instead of a power outlet. This limitation in energy puts extra constraints in the operations of sensors. As recharging is difficult, sensors should smartly utilize its limited energy in collecting, processing, and transmitting information.

Image sensor nodes suffer problems such as heavy data traffic, limited energy and computation capability. In wireless camera-based sensor networks, energy consumption of nodes is used to image transmission and processing, so it is one of the considerable challenges in these networks. This Seminar, It proposes a new approach to reduce energy consumption along with increasing networks lifetime. Security in Wireless Sensor Networks has become very much important as sensor networks are being used for sensitive applications like weather forecasting, military, medicine etc. In Wireless Sensor Network (WSN) the base station collect data from the sensor nodes and is then transmitted to the Service provider via internet. Several Imaging Sensors are also used in WSN for environmental monitoring, biomedical applications etc. Image compression and image encryption are pivotal to proper storage and transmission of images in WSN. The severe resource constraints in a sensor node make it very challenging to secure sensor networks using existing strong security mechanisms. Asymmetric cryptographic algorithms are not much suitable for providing security in wireless sensor networks due to limited computation, power, and storage resources available on sensor nodes. Therefore, the energy-efficient security protocol proposed in this paper uses symmetric cryptographic algorithms to support security. Enhanced and energy efficient image compression and encryption proposed in this paper aims at achieving enhanced bandwidth utilization and security.

II. HARDWARE RELATED TO SENSOR NETWORKS

BLOCK DIAGRAM

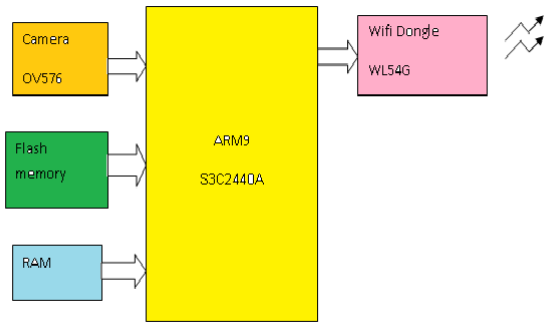


Fig 1: SENDER (Sensor Node)

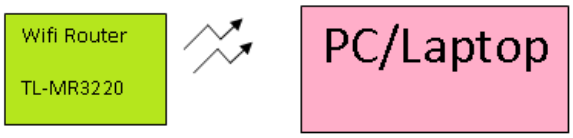


Fig 2: RECEIVER: (SERVER)

III. SOFTWARE CONCEPT OF IMAGE TRANSMISSION

A) The diagram of Fig. I & II shows what we should do in the program.The image which is captured is sent to receiver in two ways:

There are about Four steps as collect image, make JPEG compression, transmit the result in wireless sensor networks. First of all, we need to store a image in the sensor node which is responsible for image acquisition and in the gateway node or remote server. When there is a command to get images, the node collects the data of image, it then directly send the image and then or at the same time, make JPEG compression and store the data which is compressed ,and again send the compressed image immediately.

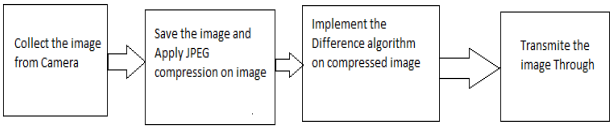


Fig. I Diagram of Program of Step I

B) JPEG Compression Concept

JPEG compression
JPEG (the English abbreviation of Joint Picture Expert Group) is a coding standard of static image, which is developed by ISO (the International Organization for Standardization) and CCITT together. Compared with the same picture quality of other popular formats (such as GIF, TIFF, PCX), the compression ratio of JPEG for static image is the highest.
JPEG compression is a lossy compression, which removes the redundant information of perspective and itself using of the characteristic of human perspective system and cooperation of quantitative and loss less compression.

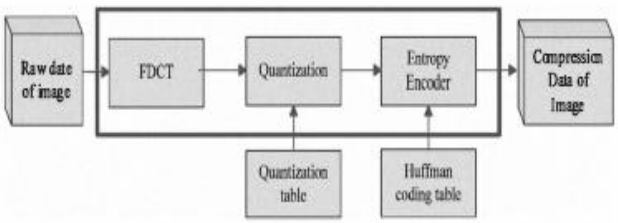


Figure 2. JPEG encoding process

As shown in Fig. 2, there are major three steps to make JPEG compression:
• Change image expressed in the space domain into the frequency domain using the algorithm of forward discrete cosine transform (FOCT).
• Quantify the coefficients of OCT using the weighting function which is the best for the human visual system.
• Encode the coefficients of quantification using Huffman encoder.

One of the hottest topics in image compression technology today is JPEG. The acronym JPEG stands for the Joint Photographic Experts Group, a standards committee that had its origins within the International Standard Organization (ISO). In 1982, the ISO formed the Photographic Experts Group (PEG) to research methods of transmitting video, still images, and text over ISDN (Integrated Services Digital Network) lines. PEG's goal was to produce a set of industry standards for the transmission of graphics and image data over digital communications networks.

C). Software process

Based on the above ideas, we can do as Fig. 3.
We just provide the main steps when node executes the command of collecting image in the diagram. There are something should be noticed which are not mentioned in the diagram, further explanation in the following simulation.

The following flow gives the detailed process of project i.e. how we are moving forward.

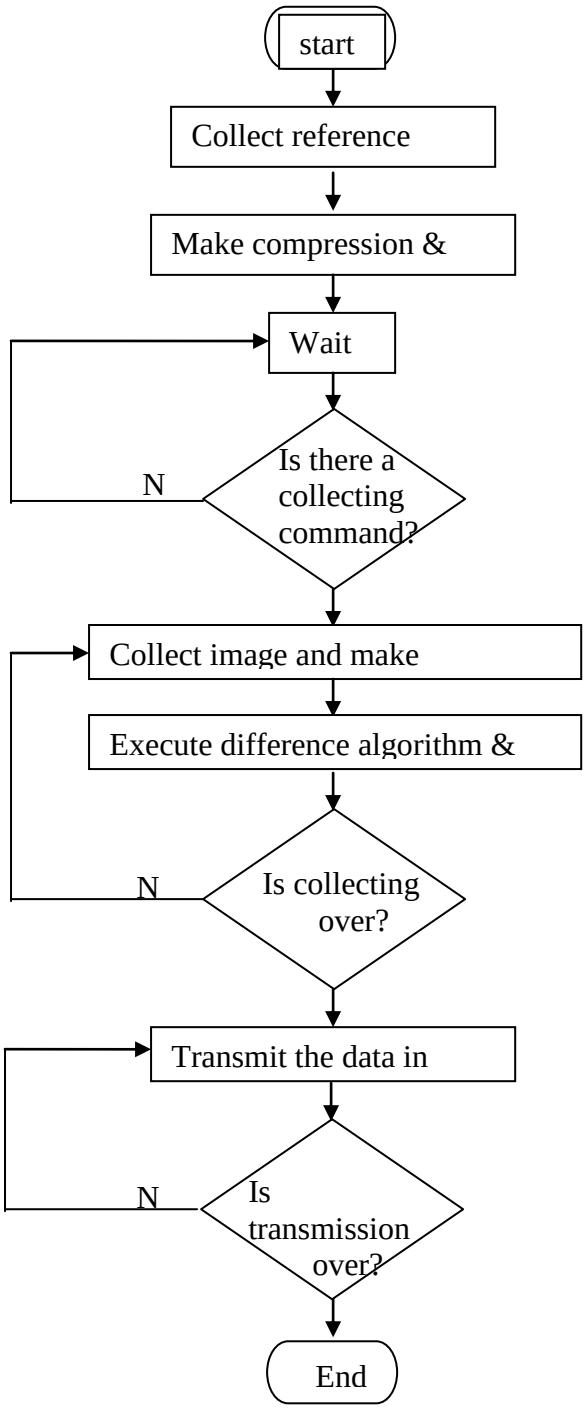
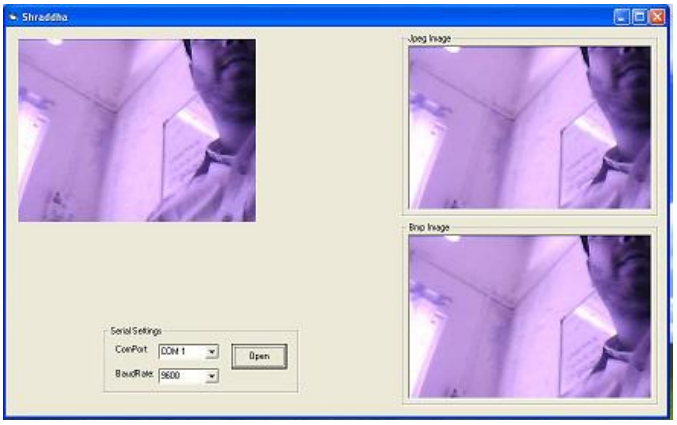
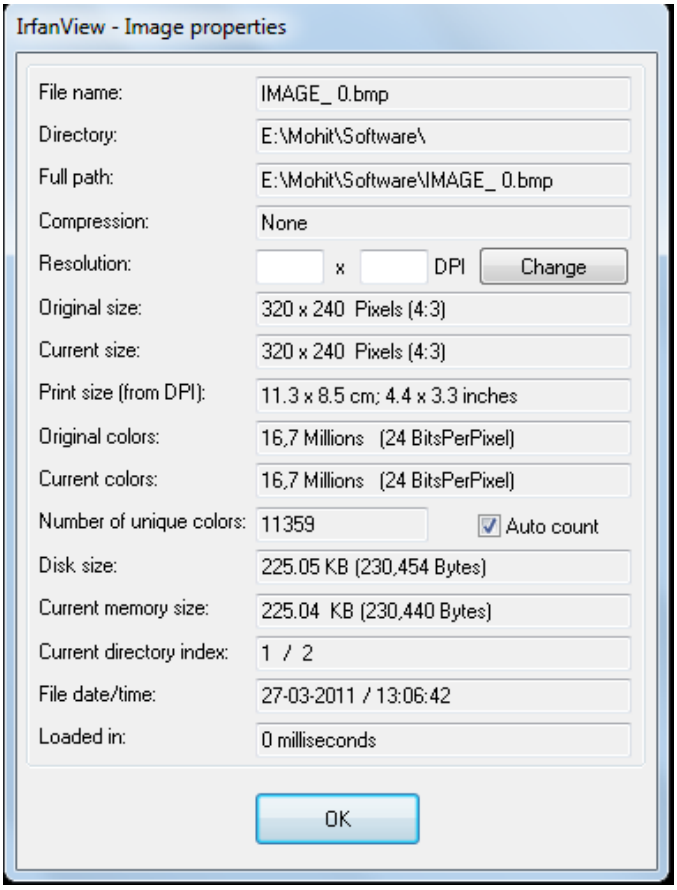
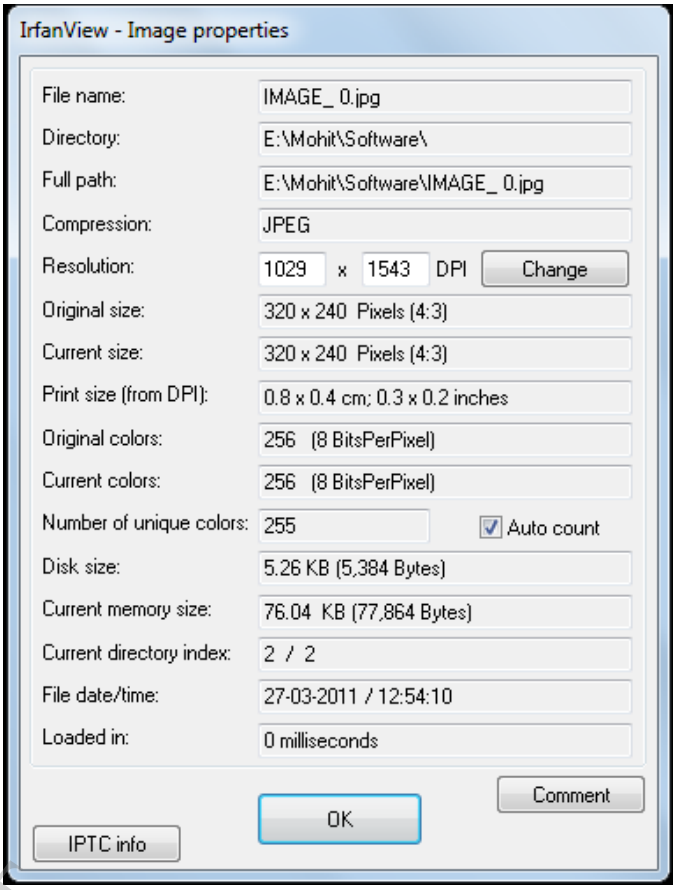


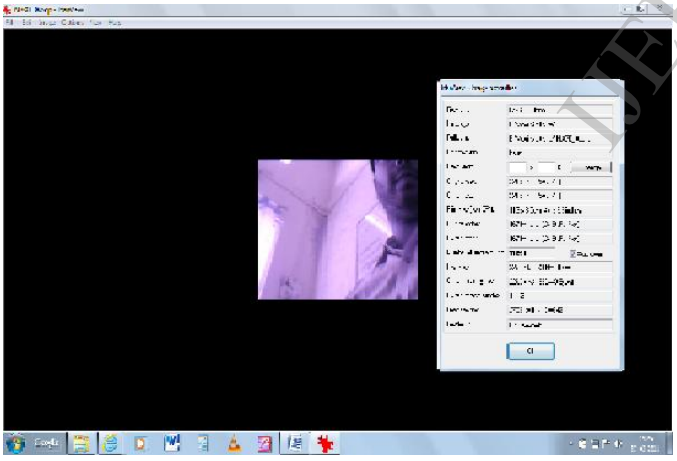
Figure 3. The software flow diagram

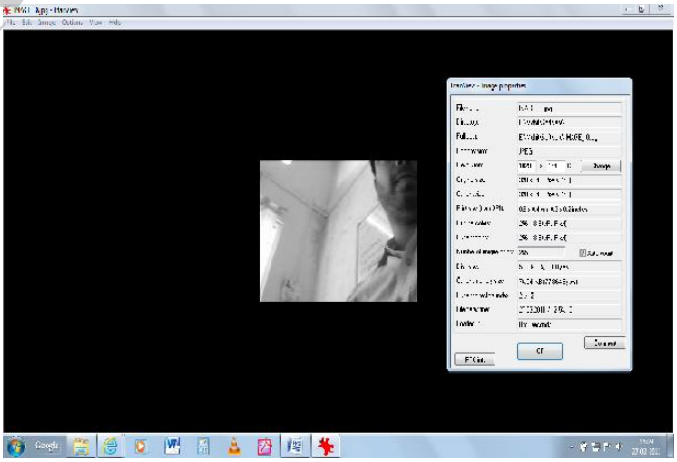
III. SIMULA TION AND ANALYSE











IV: COCLUSION

Wireless sensor network is very important platoon for intonation acquisition today. For image acquisition, this Project presents a program based on compression and difference transmission, which is aiming at reducing energy consumption and prolonging the lifetime of networks. From the result of simulation, we can see when there are a few of

changes between collected image and reference image, the program can significantly reduce the amount of data to be transmitted in network, thus, network resources will be saved a lot, the network delay will be reduced, and the lifetime of network will be prolonged. It is very important to choose a reasonable threshold in this program, which determined the amount of data in network and the quality of image reconstructed. the energy trade-offs involved in JPEG compression on energy-constrained platforms followed by wireless transmission of the compressed images. A design approach based on precision-optimized custom arithmetic was used to obtain energy-minimal, platform-specific implementations of the DCT and quantization steps in the JPEG algorithm.

Comparisons with traditional JPEG libraries show speed and energy improvements ranging from factors of 2 to 5 depending on which portion of the algorithm was considered. Comparisons across different platforms show that the JPEG energy consumption is actually higher on “low” power platforms due to the longer times needed for these platforms to perform the computation tasks to the desired precision.

The most energy-efficient and time-efficient approaches among the options of 1) transmission of uncompressed images or 2) compression followed by transmission were identified for a variety of processor/radio combinations. Advanced applications of JPEG including region of interest coding and successive/progressive transmission were presented, which lead to considerable energy savings over the use of uncompressed images or conventional JPEG.

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