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Analysis of Compression Ratio and Processing Power of Image Data Compression

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Abstract: Wireless sensor network is the main source to make the use of IoT in order to make the environment smart. Many wireless sensor networks use image data transmission. Image data is very common now a day, and it is transmitted from one node to another. Hence bandwidth can be the important parameter to be considered while sending multimedia information such as images. To utilize bandwidth in the better way image compression plays a vital role. Hence this project aims to compress the image in the sensor node and send it to master node and analyse its size and processing time taken to compress the image. Two techniques called Lossy and Lossless are applied to compress the image and corresponding analysis are made.

Keywords: Image compression, Image capturing, Raspberry pi, Lossy, Lossless.

I. INTRODUCTION

In recent years, the demand of multimedia information and their development is growing increasingly fast, which contributes to utilize more bandwidth in the network and insufficient bandwidth of network causes more problems such as speed in sending and receiving multimedia information. Therefore, to save transmission bandwidth in the network the theory of data compression becomes more and more significant. It helps in reducing the size of data without compromising on its quality.

Internet of Things (IoT) helps making the city or environment smarter. It can include variety of devices such as sensors, actuators, microcontroller, cameras etc [1]. Our project also helps to add more improvements in the day today life and make the environment work better and in this way it contributes to IoT. Now a day, there are many areas where the multimedia information plays a very important role. Information can be in the form of images, audio, video, text, line diagrams and many more. Sending this type of information requires more bandwidth in the network as this type of information has large size.

In any network many nodes are communicating with each other by sending and receiving the information. While communicating it is very important to notice about the type of data that is to be sent and received. Hence, while sending the multimedia information the sensor node must be able to gather such data by various means and then send it to another sensor node in the network. While sending the image data from one node to another node, first it is captured by using the input device such as web camera etc. captured image can be sent to sensor node which then transmit the information to another node in the network. Sensor node can be any device such as personal computer, raspberry pi etc.

Many areas such as military, agriculture, medical, industrial areas need such image data to be transmitted from one node to another. Large size of image makes use of more bandwidth. Due to this problem, the size of images which need to be transferred must be reduced and can utilize more bandwidth as possible. To reduce the size of images, there are many data compression algorithms which help to reduce the size of images with or without compromising in the quality of images. The digital cameras produce instant images, which can be viewed without the delay of waiting for film processing. But these images are large in size. The compression techniques help to reduce the cost of storage and efficient transmission of digital images. The compression techniques are mainly classified into two, Lossy compression techniques and Lossless compression techniques [2].

A. Aim of Project:

Hence this projects aims to reduce the size of image data to be transferred from one node to another. And also analyze the processing time and size by applying various compression techniques on the images. This can be done by capturing the images by using webcam and send it to sensor node. Here raspberry pi acts as a sensor node. Compression techniques are applied to the image data in the raspberry pi itself and analyze the size and time of processing. These compressed files can be sent to the master node which can be a personal computer connected with raspberry pi in a wireless network.

The paper contains the section as follows: In section II literature survey is explained, section III tells about the objective design part. Section IV tells the methodology, section V tells results and analysis, finally conclusion and references.

II. LITERATURE SURVEY

Andrea Zanella, [1] describes the Internet of Things (IoT). They tell us building the IoT environment is very difficult

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as they involve wide variety of equipments [1]. But our project contributes a little to IoT for better environmrnt.

Authors G. Senthil kumar, [2] says that "The experiments shows that the system of using raspberry pi to capture the images helped to work fast. They also told that data stream can flow smoothly between camera and raspberry pi. Camera can be connected to raspberry pi using USB slots to take images and can be passed to raspberry pi. [5]".

Wei-Yi Wei [6] says that now a days there are many areas where multimedia data need to be sent and received. Hence it may cause traffic in the network and contributes to insufficient bandwidth of network [6]. This disadvantage can cause many problems such as slow transmission of multimedia data over the network.

K.S.Shilpashree, [7] describes that "Image processing can be done in raspberry pi using python language. When the image or video is received as input it can be processed in raspberry pi can the output can be again the image or video. [7]".

Hanaa Zain Eldin [8] describes all types of image compression techniques such as lossy and lossless. It tells that lossy technique can compress the image to large extent but reduces the compressed image quality. In lossless technique the image can be compressed to less extent but cannot reduce the image quality [8].

In the paper [9], the basics about OpenCV is explained which is needed in our project to capture the image process it in raspberry pi. The OpenCV tutorial [9] tells all the basics, working and using of OpenCV.

All this study our project to analyse the various image compression techniques and compare their processing time size reduced to utilize more bandwidth.
Hence our project helps to apply various image compression techniques and analyze which can be a better technique to utilize more bandwidth and improve performance.

III. PROBLEM DEFINITION AND OBJECTIVE:

A. Problem Definition:
We propose to analyse the wireless sensor network for data transfer with and without compression. The following factors will be analysed

- Compression Ratio.
- Processing Power.

B. Objective:
Wireless sensor networks are used extensively in many of remote monitoring systems. They are the main modules in implementing IOT based systems. In many of the remote monitoring systems it is required that the wireless sensor node should take pictures and send it across to the master node. The frequency at which the pictures are taken may or may not be fast. If the frequency at which the images need to be transferred is very fast, then it becomes important to analyse the size of the images, or else it may cause severe traffic on the network, with all the nodes sending data to the master node. Hence analysis of a wireless sensor network to capture image, compress it using standard compression algorithm and transfer it to the master node. It also considers the time taken for compression on the sensor node, so that we even analyse extra processor cycles required.

C. System Design:

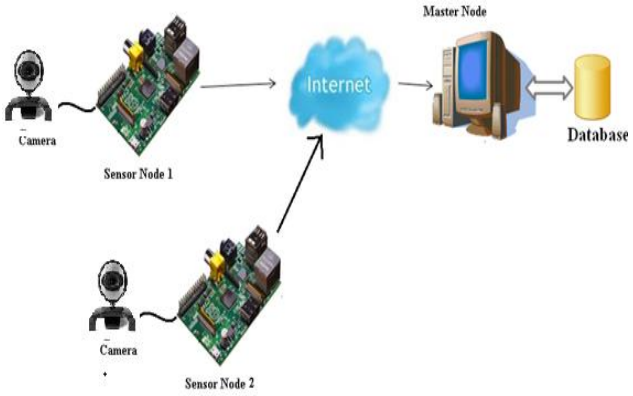

Figure 1 Architecture diagram

The above architecture describes the overall flow of the project which is as follows:

- Web camera is connected to the raspberry pi which acts as a sensor node.
- There can be more than one sensor nodes connected through wireless network.
- Web camera takes the real time image and sends to raspberry pi using OpenCV [9].
- Raspberry pi uses various compression techniques to compress the image and calculates the size reduced after compression and processing time taken to compress the image. It uses python language to do so.
- Further compressed image along with original image is sent towards the master node through communication module which is wirelessly connected. Php is used to connect it to the server or master node.
- Master node fetches the data and downloads images and stores it in the database present on the master node. The admin can analyze the processing time and compression ratio based on size of the image reduced after compression. Vb.net is used for the analysis purpose.

IV. METHODOLOGY

There are many types of lossy and lossless techniques used to compress the image. Every technique has its own advantages and disadvantages. In this project we use ANTIALIAS technique for lossy image compression and image compression using ZLIB technique for lossless image compression.
Sensor node steps:
To take picture and compress the image following steps are used:

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- Take picture using OpenCV.
- Send it to the Raspberry pi board.
- First compress using Lossy technique using ANTIALIAS, which is used to resize the image.
- Calculate time taken to compress the image using Lossy technique.
- Compress using Lossless technique using ZLIB.
- Calculate time taken to compress the image using Lossless technique.
- Note compression ratio of both the techniques.

Master node steps:
To plot the graph based on the data present in the dataset following steps is used:

- First select the latest data from the database
- One graph can be plotted based on size by taking the size values.
- By selecting the proper values for X and Y axis, bar graph is plotted by showing three bars in a single graph.
- One bar representing the original size of image, second bar representing the lossy compressed size of image and the third bar represents the lossless compressed size of image.
- To plot the time graph, select the time values from the database.
- There can be two bars in the graph for time.
- Forst bar representing the lossy time taken to compress the image and second bar represents the lossless time taken to compress the image.

V. RESULTS

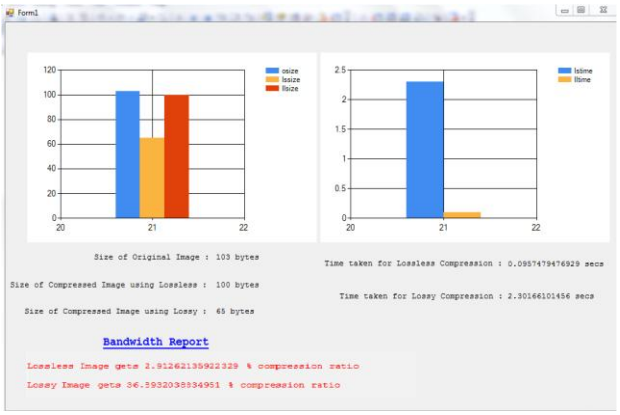

Figure 2.Graph plotted

The execution of the code starts with sensor node takes the photo and compresses it using lossy and lossless techniques. It calculates the size and time for the image and prints the same in the output screen. It also sends this information to the master node.

The master node has the application running over it and as soon as the photo is taken in the sensor node and compressed it, master node requests the data from the raspberry pi for analysis.

There are three buttons in the form which can be used for various purposes as explained below. The first button is clicked to download the image taken by camera in the sensor node. After the button is clicked the image is downloaded and after the completion of downloading process the message is displayed for successful download.

The second button is clicked to show the downloaded image, which was captured by the camera in the sensor node.

Third button is used to show the graphs plotted for analysis purpose. The graphs can be displayed in figure 3.

The below snapshot is taken for the image which has more original size of 297 bytes. It can be compressed by 2 byte to form 295 bytes using lossless compression. Also it can be compressed up to 97 bytes using lossy compression technique.

Figure 3 Graph plotted

We can observe that in lossy more compression rate can be obtained but the image quality is lost for some extent. But in lossless compression we don't compromise to quality but compression ratio is less. Hence more bandwidth can be saved in the lossy technique than in the lossless technique.

Similarly, in the time graph lossy takes more time to compress and lossless takes less time to compress the image.

VI. CONCLUSION

Image compression is the basic and very important need in today's environment as image data is transmitted in wide range in every application area. Hence by compressing image using lossy and lossless techniques performance can be improved. From all the work, it is concluded that lossless technique helps in the areas where quality is very important parameter such as medical fields, country border etc. and lossy technique helps in the areas where quality can be compromised but bandwidth saving is important as more images are transmitted. The areas like local banks, airports, industries and many more public areas.

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BIOGRAPHIES

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