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COGNITIVE DISASTER INFORMATION SYSTEM: AN APPROACH USING S3C2440C

Prof. Deepali Javale[1], Mrs. Neelam Joshi[2], Prof. Santosh Pawar[3],Mrs. Supriya Pansare[4]

[1]Asst. Prof., Comp.Dept, MITCOE, Pune, Maharashtra, India, ***dp.javale@gmail.com***
[2]Comp.Dept, MITCOE, Pune, Maharashtra, India, ***neelamnjoshi@gmail.com***
[3]Lecturer, Comp.Dept, MITCOE, Pune, Maharashtra, India, ***pawarsb1234@gmail.com***
[4]Network Dept.,MITCOE, , Pune, Maharashtra, India, ***supriya.pansare@rediffmail.com***

Abstract

For the latest development in the direction of embedded system and wireless network, this seminar describes wireless image transmission based on the embedded system. Wireless network is one of useful methods for Disaster Information Network, because it is easy to recover the reconfiguration of network topology and strong for disaster such as earthquake.. Cognitive Wireless Network consisted of multiple wireless interfaces and multiple wireless routes is considered as one of the powerful technologies to solve the problems as the previous. Therefore we have studied the transmission control methods of Cognitive Wireless Network in Disaster Information Network considering with wireless network conditions and user policy. In this method, Extend AHP is used for the optimal wireless link selection with wireless network conditions and user policy, and Extend AODV with Min-Max AHP values is applied for the optimal wireless route selection. Microprocessor S3C2440A will be the core, USB camera will be the image acquisition device and wireless network card will be the wireless transmission equipment.

Keywords: *Cognitive, Disaster Management, S3C2440*

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1. INTRODUCTION

In case of Disaster Information Network, wireless network is one of the best. The physical characteristics of wireless network may cause lack of QoS for the system. When the used radio frequency is higher, broadband communication such as video communication is suitable at relatively shorter communication distance. Lower radio frequency is suitable at long distance communication with lower influence of obstacles such as trees and buildings. Wireless LANs such as IEEE802.11b/g have spread to many houses, and these devices could be interfered to Emergent Communication System such as Disaster Information Network. Furthermore, user demands in Disaster Information Network need to be considered.

Just after disaster, connectivity is necessary and text contents transmission such as mail and WEB is preferred. Along with Internet, the wireless network and the digital video technology's development, the video surveillance system's application is getting more and more widespread. Embedded wireless video surveillance technology is widely used. For example, aerospace use radio measurement, telemetry, remote control systems, industrial and agricultural production unattended equipment monitoring, mobile office and medical monitoring, etc. The research of embedded wireless video surveillance technology has important practical significance. This article introduced a design proposal of the embedded wireless video surveillance system based on Internet. This system uses the S3C2440 embedded processor, the Linux real-time operating system, the camera and the wireless card with the USB interface, has realized to video image gathering and processing, the network termination user may browse and store and so on the monitoring image by the Internet. With the rapidly advancing information technology, the design of the embedded system turns to be a new world. It includes many fields just like industry control, consumptive electronic products, net communication, scientific study, military, etc. Also Multimedia communication over wireless fading channels has become extremely popular with the development of wireless cellular systems and wireless local area networks. However, many challenges exist in designing an efficient multimedia transmission system over hybrid wireless networks. Home automation concept is an emerging vision in modern era, which offers efficient home management system with convenience, comfort, energy efficiency and security.

2. LITERATURE SURVEY

The article described by Zhongdong Hu et. al. Introduces the hardware and software design of a wireless video surveillance system based on S3C2440 hardware platform and embedded Linux operating system[7].

It described the system's general structure, and gives the bootloader and the linux root file system is created, the kernel cutting, video image acquisition-driven and USB wireless adapter driver, etc. This system has the characters of the low cost, the system structure to be simple, the low power, the kernel can be cutting and transplantable, and also the stable property and high integration.

Hao Zhang et.al. propose a cross layer approach to wireless image transmission over fading channels. We first extract the key information from the image and transmit this information only when the channel is good to ensure that most errors occur in the less important image information.[8]. In this paper, a selective approach for wireless image transmission was considered. A cross layer design was considered where the bits in the image were chosen for transmission based on the SNR and their importance in the image. It was shown by analysis and simulation that the proposed approach can significantly improve system performance.

Many wireless technologies have been emerged recently targeting WHA, hence selecting the optimal technology is challenging. In this article A. J. Dinusha Rathnayaka et.al. present an evaluation of these emerging wireless technologies and discuss their suitability for smart home networks[9].

In this article, they compared the features of emerging wireless solutions and conclude that different wireless solutions offer comparative benefits and limitations in different perspectives. Hence the selection of suitable technology should be dependent on the requirements of selected application.

Thus all the above techniques were based on different perspectives of wireless transmission. But in this proposed work the main focus is on image transmission using S3C2440.

3. PROPOSED WORK

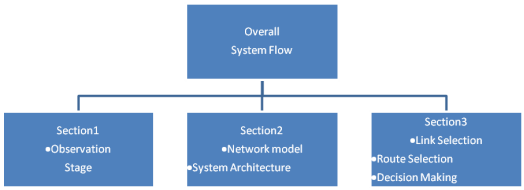

Fig 1. Overall System Flow for Disaster Information Network

Section 1

Observation Stage

First, user policy and network conditions are observed at the observation stage. Secondly, at the decision stage, the results of extend AHP for each communication link are compared, and the proper link is selected when the results are changed. Also, if there is no proper wireless links at the observing nodes, then proper route is analyzed by Min-Max AHP method based on Ad hoc On-Demand Distance Vector (AODV) algorithm. Finally, in the acting stage, the selected link or route is applied for the network.

Section 2

In section 2, network model and system architecture communication method are defined.

4. NETWORK MODEL

a. Network Configuration

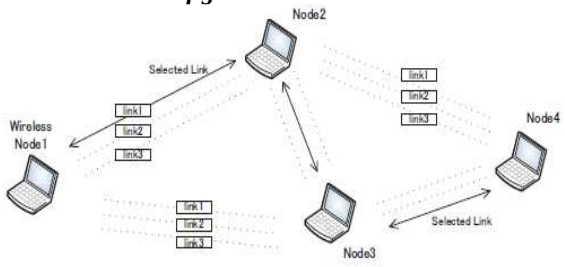

Fig 2. Cognitive Network Schematic

The lowest radio frequency link is used as the control links for the purpose of sending a network characteristic data or message of switching links. The network condition is changed over time depending on node's movement and a data transmission is carried out by ordering user request from a server to a user terminal. When a data transmission is requested or network condition is changed, the optimal wireless link and route are selected by proposed method while a data transmission is carried.

b. System Architecture

The system architecture is organized three layers, including the physical layer, the network layer, and the application layer.

Application layer - A user application is detected for the decision of user policy. A user policy is assumed to be various types like video, VoIP, text (web) including. Network data from each layer is observed, and the decision making is held with crossing through layers. Then, the message of the selected link or route is sent through link0,

The System layer - Collects type of video coding, and also performs transcoding of a video coding to another one, such as from/to Motion JPEG to/from MPEG1.

The Network layer - Observes network conditions such as the value of PER, throughput, delay, jitter, BER, electric field strength, and so on.

Section3

This stage deals with the proposal methods of observing network parameters and user policy, and describes wireless link selection, route selection and decision algorithm which are based on AHP. Then, it explains how to change link and route at supposed network. The cognition cycle consists of three stages; the observation stage, the decision stage, and the acting stage. Each stage continuously cycled in order to perform link or route configuration.

A. Observation Stage

At observation stage, network data is continuously observed through each layer. Wireless network condition varies depending on the movement of nodes or radio interference.

B. Decision Stage

When the network condition is changed, the proposed system will seek the suitable link and route by the calculating priority index from the values of network characteristics like user policy, throughput, BER, and so on.

For the selection of suitable link - **Extend AHP method a**nd
For the decision of suitable route - **Extend AODV with Min-Max AHP method**

Route Selection

Proposed system would change network route if the suitable link is not found or minimum requirement for user is not satisfied.

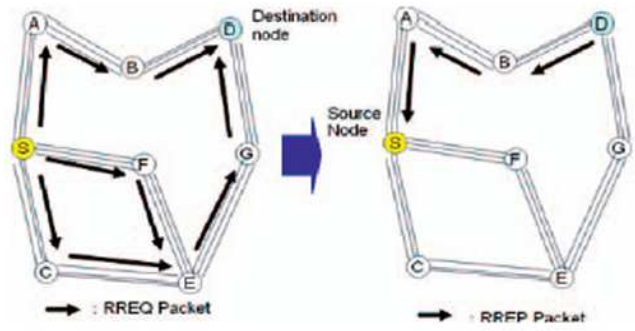

Fig 3. Route Selection

5. HARDWARE DESIGN OF THE SYSTEM

As the S3C2440A microprocessor integrated USB HOST controllers and its USB host interface can directly access USB wireless card, we can use them directly from it without having to add additional chips. S3C2440A storage system is divided into 8 groups (Banks), the size of each group is 128MB, total of them is 1GB. Bank6~Bank7 for ROM, SRAM or SDRAM, the two groups are the same large and are programmable. S3C2440A used 8 general chips nGCS [7:0] to choose these groups.

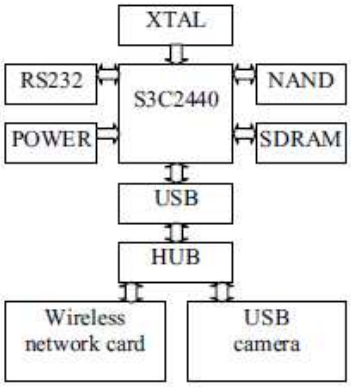

Fig 4. Hardware schematic diagram

OM[1:0]=00, the processor starts from the NAND Flash;
Because Flash has power-down features, NAND flash is used to store the starting procedure, the operating system, drivers, and related applications. USB camera and USB wireless network card is connected to the USB host controller interface through the Hub.

6. SOFTWARE DESIGN OF THE SYSTEM

Software design is based on the hardware and overall needs of the system development. The characteristics of embedded system makes an own unique method of software development, and we need a suitable software development environment. Linux is a real preemptive multi-tasking, multiuser, multi-threaded operating system, which performs very stably, powerfully, could run on many hardware platforms, has secure layered and could support up to 32 kinds of file system, supports a large number of external devices.

7. APPLICATION DEVELOPMENT

The initial image capturing and transmitting it to first node of cognitive wireless network for disaster management can be shown by the flowchart given in Fig 5.
This application is divided into image acquisition thread and image transmission thread.

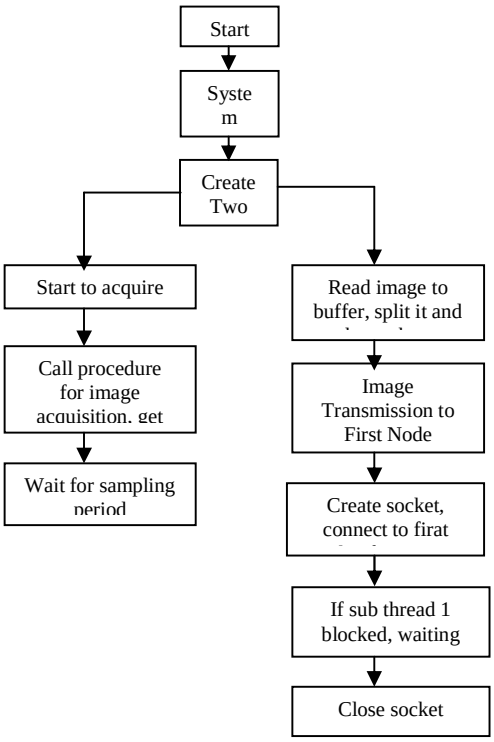

Fig 5. Flow chart of Initial image capturing and transmitting

A. Image Acquisition

The process of image acquisition is as follows:

1) Open the device to set: Operate by using the standard open-function file;

2) Set attributes of the equipment: Including brightness and contrast of the image;

3) Set the format and method of transmission;

4) Acquire image and keep it in the buffer zone:

5) Processing images;

6) Close video equipment.

B. Image Transmission

The main task of this system is the image transmission, so the data stream is large. This system requires a high reliability on real-time transmission of image. Compared to the large volume of video images data, the impact of video images is not great. Wireless transmission process is actually the socket programming under the Linux environment. In this system, the embedded system is client, PC with a wireless network card is server.

Further the image received by first node of cognitive wireless network is send to the destination node by selecting suitable link and routes for transmission as shown in fig.

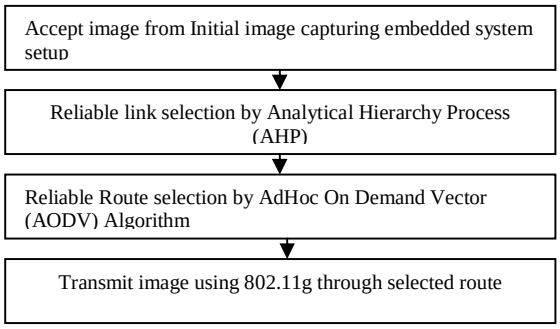

Fig 6. Route Selection and transmission process

CONCLUSION

In this paper, the transmission control methods in cognitive wireless network considering user policy are introduced for Disaster Information Network. The initial method introduced the method of wireless transmission based on S3C2440A processor and embedded technique, transmitted image data successfully. The realization of wireless transmission makes the application of embedded system in the network field a new world.The proposed method on the image/video transmission shows that the proposed methods can change to the best suitable link and route to maximize the transmission rate based on user policy by Min-Max AHP method which we proposed. The proposed method can be made easily practical, efficient and reliable to support data transmission.

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BIOGRAPHIES

Prof. Deepali Javale, Assistant Professor, MIT College of Engineering, holds Bachelors Degree in Computer Engg. and recently Pursuing Master of Information Technology from Pune University. She is having 6 years of teaching experience. Her expertise is in the field of Embedded Systems and Data Mining