k-path diffusion method for Multi-vision Display Technique among Smart Devices

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k-path 확산 방법을 이용한 스마트 디바이스 간 멀티비전 디스플레이 기술

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ABSTRACT

Our research is different form traditional to have some large LED screen grouping together to constitute multi-vision technique. In this paper, we purpose a method of using *k*-path diffusion method to build connect between the devices and find an optimal data transmission path. In second half of this paper, through practical application, we using this technique transmitting data successfully and achieving a simple Multi-vision effect. This technique possess smart devices and Wifi P2P's features, these features improve system's dynamic and decentralized processing ability make our technique has high scalability.

1. Introduction

Here we discuss about multi-vision what some small screen combined into a big one and in the one frame have some screen and mapping and displaying in same time. So we also call it: multi-screen or multi-image.

H jung, D kim and H kim wrote in the their paper: In order to provide users with a sense of reality based on features of expandability that the audiences desire more information and wish to watch more wide screen, visual effect, interaction of motion, auditory effect, tactile effect and various other effects are used.[2]

With the continuously growing number of smart phones and tablets provide convenience to our live. In this study, we explain a method can realize multi-vision effect by using smart device. this method which is different from the traditional one, each device not just use screen to display the received date. In our study based on Wifi P2P, it mark for devices supporting a technology that enables Wi-Fi devices to connect directly, making it simple and convenient to do things like print, share, sync and display[1]. And using the features of smart devices to make more effect to users.

2. Related Work

About Multi-vision, there have some related studies. browser-based technology they have created the Junkyard Jumbotron[3] which allows users to cluster a group of screen-based devices(including smartphones, tablets and laptops) to form a lager screen. After bringing up a unique URL on each device, one takes a photograph of all the screens, which is the analyzed by special software that maps out the location of each screen in relation to the others. Then the image can be transmitted to multiple devices at once, creating a fragmented, mosaic-like effect. M Li and L Kobbelt utilizes host-client structure and in their system[4] each device renders the same multimedia data locally and its individual view of the redering is determined by visual recognition. Through the front-facing camera of device to recognize the visual pattern and it will provide the position and orientation of the device in the maker coordinate system, form which they can compute the correct viewport of each device. A team form Aalborg University Centre for Socio-Interactive Design shows the results of their study JuxtaPinch[5], JuxtaPinch use pinching to connect devices and it enables flexible physical positioning of devices and supports partial viewing of photos. Some studies show the advantages of P2P[7], they using P2P connect device to building distributed user interface applications[6].

3. Method Concept

In related work, majority of them have used server-client structure, they need to have a single server and installed the corresponding application or browser to receive the data from the server. It is not much difference with traditional multi-vision technology. We refer to the concept of ubiquitous computing design this technique, make each device no longer a simple data receiver, using the mobile device's own data processing function makes the system more intelligent and decentralization.

Suppose there are a lot of device need to join the system or server need to send a large data like video, game or screen shot data, server or network maybe to bear a higher load lead inefficient data transmission.

In this paper, *k*-path is defined as that optimal data diffusion path among devices through analyze device and device's surrounding(network, device's specification)

In our system we adopt the way of Wifi P2P to establish peer to peer connection and this connection is active. In here we have some devices A, B and other devices, first the device A create broadcast receiver and start discoverPeers() method to discover device as Fig.1. Discovered devices are recorded in the Device List. In Device List device's number and sort order as Adjustment data transmitted with Content data. The Content data means contents what user want display in device like picture or video. There two kinds of data are transferred to next device, In Fig.1 we can see Device B receive data and according Adjustment data to adjust contents, then the device display contents.

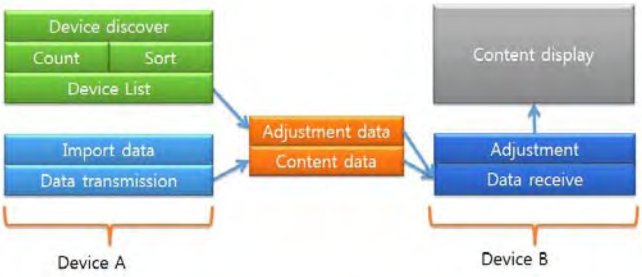


Fig.1. Process of discover, connect and transmission in two devices

4. System architecture

Before describe system architecture, let's suppose we have 9 devices in the system, 3*3 matrix-arranged. Device D have a picture import to system, according to the traditional approach is device put the photos upload to server, than server sends the data to other devices(or device D directly transfer to other devices), but in our system D only establish connection with C and E. After C receiving data from the D, C establish connection B, then transfer the data to B. E received data from the D, E will establish connection and send the data to F. And so on all devices will be get D's image data as Fig.2. Any devices in this matrix can use this way to share data.

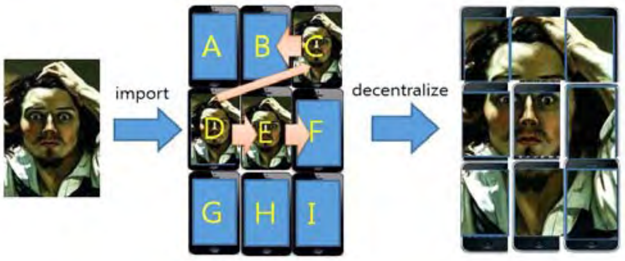


Fig.2. Devices transmit data in two directions and starting from the device D

In order to achieve this effect need to make Linklist at each device. In here *k*-path's k value is two(data transfer direction are previous device and next device). So Linklist need have two points which point to the previous device and point to the following device as Fig.3.

System according sequencing of device join to mark devices, for example: the third to join system device will be marked C, and fourth is D. D produce LinkList and let a point to the device which join in system before the D marked C device. if after Device D there have no device, the second point is null. Otherwise second point to device after D, about E. Perhaps in the 3*3 matrix-arranged system *k*-path's k = 2 is most efficient, but how about in the 10*10 matrix-arranged? In the future work we will find optimal path through the experiment for various situations.

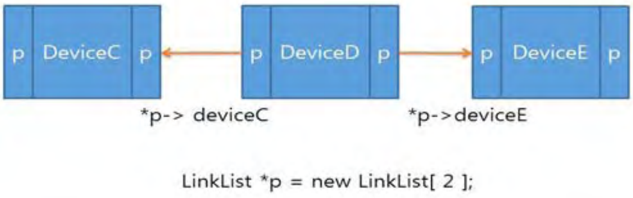


Fig.3. Each device's Linklist have two point: previous point and following point

The device according to their own situation to processing the received data. For example, image sharing: Each device display only a part of the picture as Fig.4.

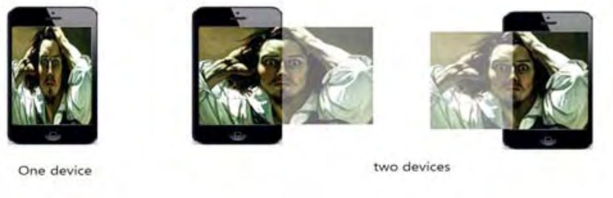


Fig.4. Two devices show part of the picture

As mentioned before, Adjustment data effecting the picture like Fig.4.

5. Current proceeding

We use android as experiment platform to write a program. Assume y_0 is set of all points for one picture, when the picture's length and width amplified J times and K times, it will to be new points set as x'y'. By matrix,

$$\begin{pmatrix} ' \\ Y' \\ 1 \end{pmatrix} = \begin{pmatrix} & 0 & 0 \\ 0 & K & 0 \\ 0 & 0 & 1 \end{pmatrix} \times \begin{pmatrix} X0 \\ Y0 \\ 1 \end{pmatrix}$$

Using the matrix method of android supporting, import J and K to the matrix: matrix.postScale(j, k), import matrix into function as parameter to enlarge image: Bitmap.createBitmap(picRes, 0, 0,picWidth, picHeight, matrix, **true**). picWidth and picHeight are the size of the original image as Fig.5.

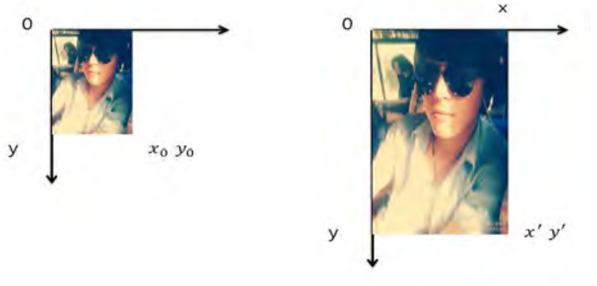


Fig.5. device enlarge processing with received picture.

Then each device according to their different needs, show part of picture. in android we continue to use createBitmap() to cut a part of this picture. Bitmap.createBitmap(picNewRes,0,0, screenWidth/2-50, screenHeight/2-50, sw/4, sh/4), in here, screenWidth and sreenHeight are new picture's lower right endpoint coordinate value.

For example, if we want to put the picture into four parts, we need find central point x″y″, and according to new point x'y' we got, we can building reference frame as Fig.6. We can see several red points evenly distributed on the picture, we call them "key point", some points as staring points and endpoints. if we want make device to display first area of this picture, we need import (0,0) and (x″,y″) as parameter into createBitmap() function like Fig.7. And so on second, third, fourth area import (x″,0)(x'y″), (0,y″)(x″,y'), (x″,y″)(x',y').

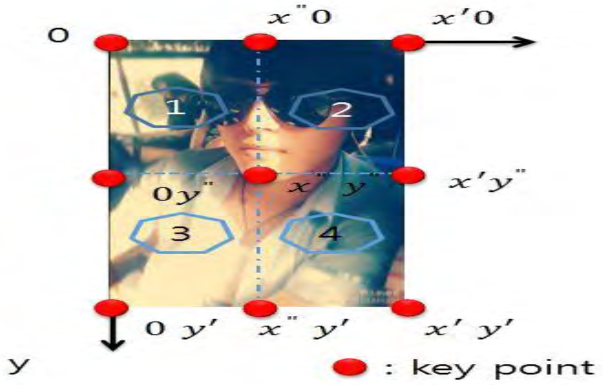


Fig.6. By the information of device's number to get "key point" for the picture.

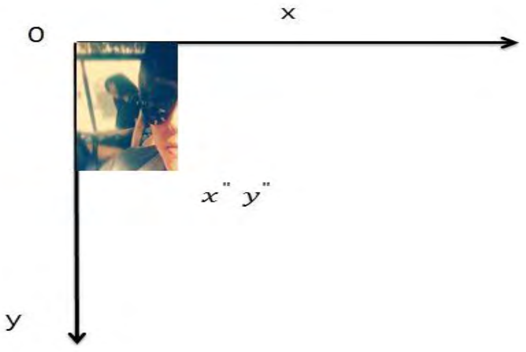


Fig.7. Cut picture and show remaining sections

In our work, starting point and endpoint as data transmitted to device, according to different needs to combine. For example point (0,0) as starting point and (x'y″) as endpoint. Through adjust picture's length and width, frist area and second area can display in one device.

We use the method which described in above make three devices have same image data as Fig.8. according the display mode we set, devices selectively import appropriate parameters to adjust their display area for combine a complete picture as Fig.9.

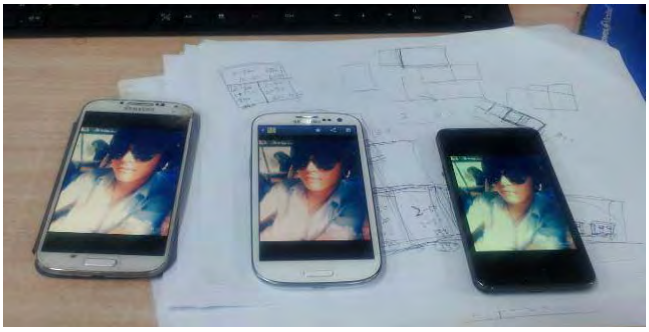


Fig.8. Through Wifi P2P to share a picture

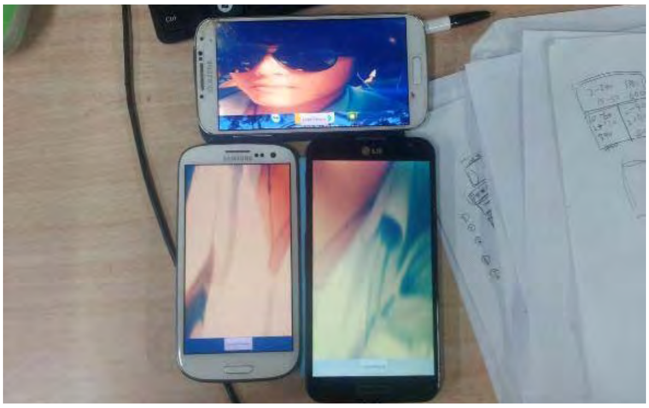
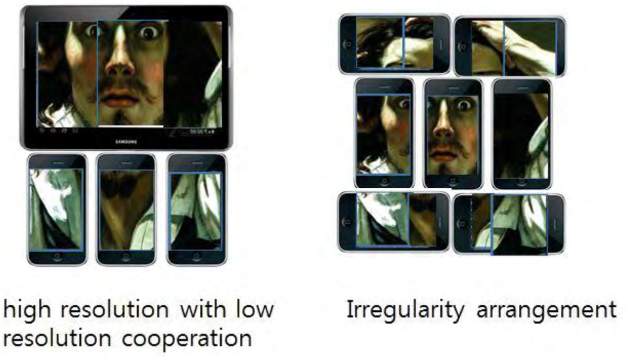


Fig.9. System depending on different position of each device to adjust display mode



high resolution with low resolution cooperation

Irregularity arrangement

Fig.10. Devices's resolution is different and device irregular arrangement.

6. Future work

In the coming work, we are going to perfect our technique from several directions: 1. In order to enhance data transmission efficiency and expand technique support more devices can join in, through experiment we will find optimal data diffusion path in each case. 2. when two or more devices swap the position, system can recognize and respond. In fact about this point we have solutions, we will be improve this solutions through the experiment. 3. sharing content is no langer limited to image and video, Sharing a device's screen is also very interesting things. 4. If devices are irregular arrangement, this technique will have an algorithm to help device to adjust display to make the multi-vision look more smooth and Many devices have big difference in resolution, how to adjust the display mode is also we need to consider in future as Fig.10.

Acknowledgement

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