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An efficient image processing method based on web services for mobile devices

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Abstract. The traditional image processing system which is based on a centralized computing model has a disadvantage of limiting resources. This can cause troubles in the smooth execution of system in mobile devices. We propose a new system which unlike traditional system uses a distributed model. It can be achieved by adopting web service based image processing system. Our system has the advantages of being component oriented and has low coupling and high encapsulation. Thus our system can solve the main problem of traditional image processing system and avoid the resource bottleneck situation.

1. Introduction

Image processing is one of the the most complex task faced in computing. Due to its complex nature image processing software tend to be rather large. The image processing software is also very demanding on the system hardware [1]. It imposes hard restriction on devices that does not meet the minimum system hardware requirements. Traditional image processing are far too resource hungry to be implemented in mobile devices. The above problem creates a hindrance for effective image processing in mobile devices. The solutions to the problem of image processing have been entirely focused on centralized nodes till date. In order to cope with the limited resource mobile devices importance is given to developing better image processing algorithms and hardware and software co-design. However this greatly compromises the portability of the system [2]. An efficient solution to the limited resources problem of mobile devices is yet to be determined.

This paper aims to come up with an effective method based on web services to solve the inefficient image processing by mobile devices. Web service is a new distributed computing technology aimed at making best use of the wide variety of network computing resources and brings about effective resource sharing [3]. The image processing services should be registered like any other web services. Its publication and discovery should be done at the server side before it can be accessed by the mobile clients. The mobile clients can invocate specific services based on need. This in turn reduces the mobile devices resource consumption which helps the device to perform complex image processing with ease.

2. Related work

Image processing as a web service is implemented by Services oriented architecture. Service providers own the services and provide a platform for the clients to access the services and to publish in centre for service registry [4]. Service requesters can search for and identify needed services and access the information system binding in the registry centre. Web service based system has a service provider, service registry and service requesters and these are the core architecture of the system. Service

registry provides all the binding information about the services provided to the service requestors. The service requesters can access the specific service by analyzing the information offered by the service registry. Using web service has many advantages [5]:

- High Encapsulation: Users can only view a list of services that are provided by objects.
- Loose coupling: Unless the service interfaces change, changes in the services won't affect the service requestor.
- Standard Protocols: As the protocols are standardized in every system, it will be easier to process for the machines.

3. Design and architecture of the System

Definition 1: Service Request of image processing over web service[6]:
The service request can be defined as:

$$R = \langle K, C \rangle$$

- R=Request
- K=Set of parameters of Request R. Here k is byte array of images.
- C=Parameter constraint set. Constraints of format of image such as JPEG, PNG , BMP ,GIF.

Definition 2: The web service can be defined as

$$WS = \langle R, Q, Res, Qos \rangle$$

- W.S= Web service names.
- R=Request
- Q=Description of specific service and
- Res= Memory usage of service.
- QOS: Quality of Service of web service. Here it denotes response time.

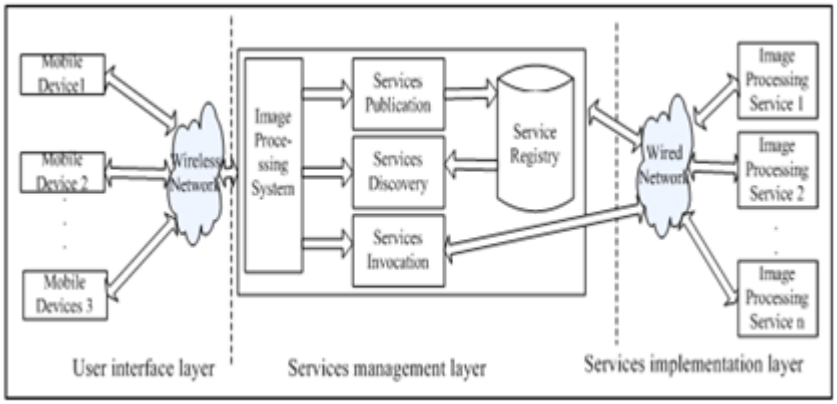

Fig. 1 Abstract view of Framework

It has 3 layers [7]:

- User Interface Layer: It is the platform of implementation in which our system is based on. Users can connect to the system using different wireless data transmission technologies such as Bluetoot ,mobile data, wifi etch to process the image through the interface.
- Service management Layer: The functions of service management layer are publishing the service, discovering the service and assuring quality of service.

- Service Implementation Layer: This layer finishes the tasks of the specific image processing. The services are stored in various locations. These are known as “racks” and they provide different interfaces but hide the details of processing.

A service can be viewed as an object stored on the web. The development of our system is different from the usual system development. It has the following steps [8]:

- Construction: We have defined different definitions and explained various levels of image processing. It also provides various processing services such as black and white, true color, anti-color etc.
- Deployment Stage: The various service interfaces and the descriptions are published in the registry. The path in which services interface are stored in the registry are defined in UDDI and the services are defined in WSDL. So the requesters use the address provided in UDDI and use the specific services described in WSDL and use the image processing services.
- Service Discovery Stage and Invocation: First, the client configures the IP address of registry which in turn provides the address and description of the service. After that clients invocate the service.
- Service Management Stage: Various problems regarding the security are effectively dealt in this stage. It keeps the data from being destroyed by an attacker.

4. Implementation

The various steps are:

- The clients have to validate the format of image file.
- As there is only a limited data transfer rate for mobile devices we have to reduce the size of the image file by compressing it.
- The image is converted to bytes.
- Client requests are sent inquiring the image processing services to the registry. Registry performs searching for services specified by the customer in his request. If they are discovered the description is sent back. Client invokes the specific services by its description. After the tasks are completed, the resulting image is sent back to the client.
- The client system converts bytes into images.

One of the main tasks of the system is discovering the services int registry according to the request sent by user. Let set R= {r1, r2...rm} be image processing service requests [9].

- ResultSet= Denotes services discovered in the service registry
- P= {p1, p2…pn} - services in the service registry.
- pi= {s1,s2…sk} (i=1…n) - set of the services $that finish the same tasks.

The algorithm for Web Service Discovery is given below:

```
Algorithm-WSDA
1   Initiate ResultSet=Ø;
2   Foreach r_i in Set R
3       Search_Tag=False
4       Foreach Candidate p_i in Set P
5           IF (p_i description match r_i request)
6               Foreach Candidate s_i in Set p_i
7                   IF (s_i entrance parameters match r_i )
8                       ResultSet= ResultSet ∪ {s_i};
9                       Search_Tag=True;
10                      Break Foreach;
11          IF (Serrch_Tag==True) Break Foreach
12      IF (Search_Tag==False)
13          ResultSet= ResultSet ∪ Ø
14  Return ResultSet
```

Fig. 2 The proposed Algorithm

5. Conclusion

We have proposed a image processing technique based on web service in this paper. We have also mentioned the two image processing systems i.e. distributed computing model based and centralized computing model based. Our proposed system will be more efficient and effective compared to the traditional system as it was various advantages such as low response time and memory usage. In the future we will work on providing an optimized and efficient WSDA algorithm and image processing services.

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