Adaptive Distributed System Considering Multi-User Based Multi-Channel Signal Processing Response Time

Seok-Hee Lee

Abstract Background/Objectives: ***Research and development are required to process various types of sensing data in fields, such as personal emotional information, from video, voice, vital signals, and complex environment conditions.***

Methods/Statistical analysis: ***The distribution processing technique must determine the private emotional state based on the instant synchronization of each real-time processing with each cognitive emotional estimation module from multi-user, multi-channel sensing data.***

Findings: ***This study presents a management method using the multi-dimension link vector information about multi-user experiences, multi-channel sensing, and cognitive emotional state modules with statistical threshold of processing time.***

Improvements/Applications: ***These systems include the management method of the delay time of emotional data for the integrated multi-channel information. This study proposes an adaptive distributed system based on multiple users and channels by generating the request information of the distributed processing according to specific weights in the real-time system that processes and transmits various signals.***

Keywords: ***Adaptive, Distribution of Automatic, Real-time System, ResponseTime, Delay Time.***

I. INTRODUCTION

The development of information technology and ubiquitous computing are applied in real time. Internet of Things (IoT) is an emerging technology that supports modern technologies. In IoT, objects or devices are used to exchange information via the Internet [1]. Device identification in IoT security distinguishes between hardware and technology of objects, or devices. This technology processes data based on a communication system over the Internet and uses a sensor for acquiring signals from an external environment [2]. Owing to developments in IoT, appliances, mobile terminals, small embedded terminals, and devices incorporating various sensing devices are now connected via Internet. These IoT devices contribute to Internet of Everything and use big data, Internet-based technology, and cloud computing for communicating, sensing, and processing [3]. Typically, Oracle proposes machine-to-machine (M2M) as a sensor, a gateway, and as a service platform for rapid interworking between different devices [4]. Oracle is delivering an application plan for the Oracle product family, targeting the IoT platform that applies to these proposed components. In IoT platform, sensing information is distributed, processed, and delivered to a user as a service via a sensor. The platform is divided into hardware terminal devices, device platforms, middleware, and application platforms.

Several previous studies processed real-time sensor data for semantic management of streaming data[5, 6], whereas some developed multi-sensor nodes [7]. Some studies attempted to improve the delay time for distributed computing of processing nodes; however, they were based on hardware-based nodes [8].

The present study proposes an automated distributed processing method for the dynamic processing of sensor data and application in multi-user environments, including hardware and multi-sensor devices.

II. PROCEDURE FOR PAPER SUBMISSION

A system that processes images, videos, voices, environmental, and other sensing information for IoT real-time processing[9] requires a method to reduce server overload because it involves real-time streaming of multi-channel data. In such systems, the changes in processing speeds must be dynamically detected by presenting problems involving static dispersion processing. A large amount of information can be distributed in real time via sensing. The proposed system comprises a real-time platform, multiple users, multi-sensor devices, and multi-service and processing modules as shown in figure 1.

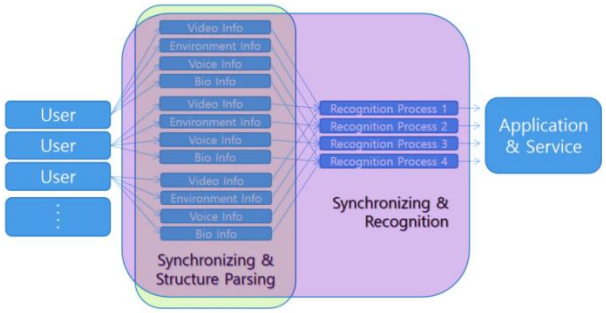

Fig 1. Diagram of Base Process Block

2.1. Proposed System Requirements

The proposed system extracts information about delay time via complex

Revised Manuscript Received on May 22, 2019.

Seok-Hee Lee, Department of Computer Science, Namseoul University,91, Daehak-ro, Seonghwan-eup, Seobuk-gu, Cheonan-si, Chungcheongnam-do, 31020,Republic of Korea
trinity@nsu.ac.kr

processing of various real-time user signals and calculates time in relation with these elements, as this empirical time information has an automated threshold value. The proposed system can be applied when the functional requirements for the base system are as follows.

- Module for time measurement lists all modules in order of matrix processing.
- Measure the unit processing time of all modules.
- In multi-channel signal server operations, multi-channel signals are classified according to the classification of each processing and the processing time is measured, stored in processing time's DB, and managed.
- Classify and manage multi-channel signals and classification tables for multiple users.
- Record processing time DB and manage the information and change the threshold value for the user.
- Manage information in the form of a hash table by updating information aboutthe rate of change of the threshold.
- Involve real-time user and unit/integration processing time information so that the existing delay time information about the rate of change and current delay time information can be mapped.
- Automatically analyze and process the reference hash table for distributed processing.

2.2. Function of Time Measurement Module

The following functions must be provided for automatic distributed processing based on processing time.

- It is necessary to process temporal flow from user's multi-channel signal processing analysis module to the emotion recognition module.
- Depending on the module, a single signal requires a flow of parallel processing.
- Equipped with unit time measurement module of all functions.
- Static and dynamic modules of time measurement.
- Obtain information on single user's time measurement results.
- Acquisition of single signal time measurement result.
- Acquisition of processing time measurement per initial signal.

The time of the proposed time measurement modules is used to obtain the limit of physical resources as logical Information. The software logically determines the resource limitation and automatically distributes them using real memory; the processor is likely to be different from the actual limit and is systematically dependent.

2.3.Calculation of Total Time of Function Block

Since the proposed scheme is a system for processing several signals, we propose the following based on processing time information about single signal processingas shown in figure 2.

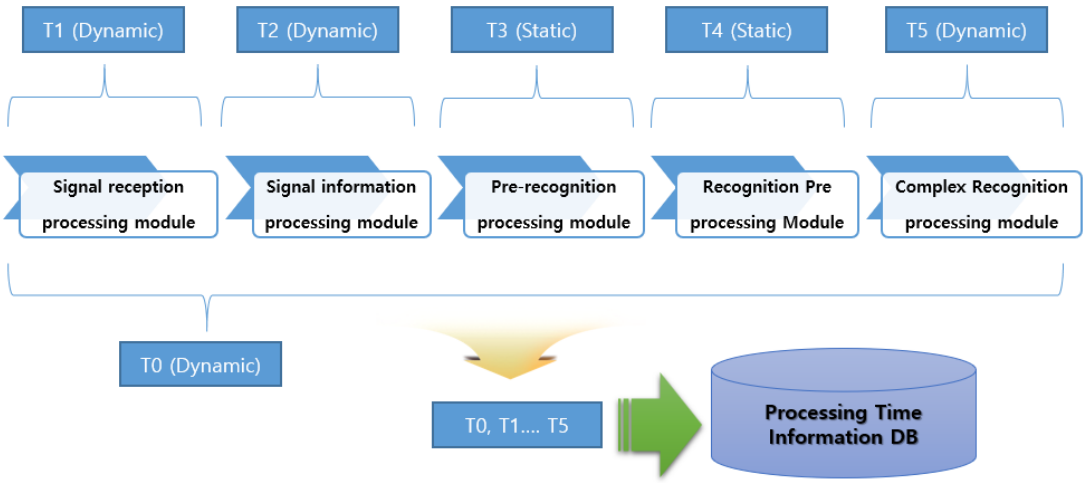

Fig 2. Diagram of function block total time calculation

We propose a method to measure time by using a system for processing several signals of a person. Therefore, the time from sensing to processing and service can be calculated for each module.

Table 1: Time measurement by Sensing Type

Sensing Type	T0 (total)	T1 (signal-start)	T2 (signal-process)	T3 (recog-prevproc)	T4 (recog-precoss)	T5 (recog-afterproc)
Bio1(Ex)	S 3.826	S 0.518	S 0.325	S 1.042	S 1.238	S 0.843
Voice	D .	S .	S .	D .	D .	S .
Video	D .	S .	S .	D .	D .	S .

Env	S .	S .	S .	S .	S .	S .
Bio2	S .	S .	S .	S .	S .	S .
etc	.	.	.	.	.	.

Assuming that the module for a person's treatment is a hash table that can be measured as shown in Table 1, the time measurement module for the treatment of several persons can be regarded as shown in Table 2.

Table 2: Time measurement by Multi-Users

	Sesing Type	T0 (total)	T1 (signal-start)	T2 (signal-process)	T3 (recog-prevproc)	T4 (recog-precoss)	T5 (recog-afterproc)
user1	Bio1(Ex)	S 3.826	S 0.518	S 0.325	S 1.042	S 1.238	S 0.843
	Voice	D .	S .	S .	D .	D .	S .
	Video	D .	S .	S .	D .	D .	S .
	Env	S .	S .	S .	S .	S .	S .
	Bio2	S .	S .	S .	S .	S .	S .
	etc	.	.	.	.	.	.
user2	Bio1(Ex)	S 3.826	S 0.518	S 0.325	S 1.042	S 1.238	S 0.843
	Voice	D .	S .	S .	D .	D .	S .
	Video	D .	S .	S .	D .	D .	S .
	Env	S .	S .	S .	S .	S .	S .
	Bio2	S .	S .	S .	S .	S .	S .
	etc	.	.	.	.	.	.
user3	Bio1(Ex)	S 3.826	S 0.518	S 0.325	S 1.042	S 1.238	S 0.843
	Voice	D .	S .	S .	D .	D .	S .
	Video	D .	S .	S .	D .	D .	S .
	Env	S .	S .	S .	S .	S .	S .
	Bio2	S .	S .	S .	S .	S .	S .
	etc	.	.	.	.	.	.

As shown in Table 2, the processing time required by the module for processing various sensing signals and for final application and service is based on the empirical database for automated distributed processing via time information.

III. RESULTS AND DISCUSSION

3.1 Automation using Processing Time Information

To determine the delay limit for the automatic decentralization of the proposed IoT real-time processing platform, the basic components are multi-user, multi-sensing information, multi-processing module, and service application module.

The proposed scheme of time table mapping to calculate several user signals is based on the elements and processing blocks to be sensed, the user ID, and the number of users, as shown in Table 3.

Table 3. Time table mapping proposal technique

```
Mapping Element: Block ID & Sensing Type & User ID
User ID % User Count = User MP (MP : Mapping Value)
Sensing Type % Sensor Count = Sensing MP
Block ID % Block Count = Block MP
Search(User MP, Sensing MP, Block MP) = Array(User MP,
Sensing MP, Block MP)
```

※ A comparison and analysis technique using direct memory and access hash techniques.

Direct hashing is proposed as the fastest approach for processing many users, sensing information, and modules, as shown in Table 4. This method has accessibility to middleware for database processing and scalability to the library.

Table 4. Time Table Mapping Proposal Technique

```
/* Signal total time calculation routine (Single User)
User ID % User Count = User MP
Sensing Type % Sensor Count = Sensing MP
Foreach(Block Time, Array(User MP, Sensing MP, *))
{
Sensing Total Time += Block Time;
}
/* Signal total time calculation routine (Multiple User)
User ID % User Count = User MP
Foreach(Sensing Time, Array(User MP, *, 0))
{Foreach(Block Time, Array(User MP, Sensing MP,
*))
{ Sensing Total Time += Block Time;}
Total Time +=Sensing Total Time;}
```


Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication

3.2 Multi-Time Processing for Experience Information

Distributed processing systems in the IoT platform environment must meet the following functional requirements:

- Single user sensing processing module time and total processing time DB
- Real-time processing module
- Comparing of reference time with real-time processing time
- Updating empirical statistical time information for real-time processing
- Comparing and analyzing empirical statistical information on single processing and multi-user processing times

Once the requirements of these functions are met, the average time of the individual sensing information processing module can be obtained, as shown in Table 5. The total time from the personal sensing information processing to the application and service can be calculated. As a result, the average processing time of the user can be calculated.

Table 5. Analysis via Experience Time Information

(MAT)Module Average Time MAT1 = (Tm10+Tm11+Tm12+…+Tm1N-1)/N (N: Testing count) (PTT)Processing Total Time PTT0 = Tm10+Tm20 +Tm30+…+TmN-10 (N: Module count) (UAT)User Average Time UAT = (PTT1+PTT2+PTT3+…+PTTN)/N (N: User count)

- Comparing Real Time Module Time with MAT
- Real-Time Processing Total Time vs. PTT
- Comparison of real time user average time with UAT
- Automatic Min / Max threshold setting for real-time processing.

We use the average time of the processing module, the total processing time of one user, and the average processing time of each user to utilize the information as time information. Finally, the maximum and minimum values of the delay time relating to the processing in the steady state can be set as the threshold value. This can provide a source of future dynamic thresholds for system resources.

IV. CONCLUSION

Currently, the development of IoT based systems is rapidly evolving through applications with intelligent systems. However, standard and processing platforms for such systems have not been developed yet. This study proposed an automatic distributed processing method and a study of platforms for processing various sensing information of different users over time.

This study discussed the methods and proposals for an adaptive distributed system for distributed processing on a platform that requires real-time multi-users, multi-sensors and processing, and application systems. The proposed model will be applied to artificial intelligence, sensory information processing, mass data processing, and data mining in the future.

Future studies will include the distribution of load balancing and processing load balancing according to empirical processing of each element, and the evaluation of the load distribution of processing and the provision of a specific model of distributed processing used in various fields and a library providing form Research is needed.

ACKNOWLEDGMENT

For this paper was provided by NamseoulUniversity.

REFERENCES

1. Gubbi, Jayavardhana; Buyya, Rajkumar; Marusic, Slaven; Palaniswami, Marimuthu. (2013). Internet of Things (IoT): A vision, architectural elements, and future directions. Future Generation Computer Systems ,29 (7), 1645–1660
2. Mitchell, Shane; Villa, Nicola; Stewart-Weeks, Martin; Lange, Anne. (2014). The Internet of Everything for Cities: Connecting People, Process, Data, and Things To Improve the 'Livability' of Cities and Communities. Cisco Systems.
3. Antonio J. Jara, LatifLadid, and Antonio Skarmeta. (2013). The internet of Everything through IPv6: An analysis of challenges, solutions and opportunities. Journal of Wireless Mobile Networks, Ubiquitous Computing, and Dependable Applications (JoWUA) 3.4: 97-118.
4. Kim, J., Lee, J., Kim, J., & Yun, J. (2014). M2M Service Platforms: Survey, Issues, and Enabling Technologies. IEEE Communications Surveys and Tutorials, 16(1), 61-76.
5. Abadi, D. J., Carney, D., Çetintemel, U., Cherniack, M., Convey, C., Lee, S., ... &Zdonik, S. (2003). Aurora: a new model and architecture for data stream management. the VLDB Journal, 12(2), 120-139.
6. Cherniack, M., Balakrishnan, H., Balazinska, M., Carney, D., Cetintemel, U., Xing, Y., &Zdonik, S. B. (2003, January). Scalable Distributed Stream Processing. In CIDR (Vol. 3, pp. 257-268).
7. Blum, R. S., Kassam, S. A., & Poor, H. V. (1997). Distributed detection with multiple sensors II. Advanced topics. Proceedings of the IEEE, 85(1), 64-79.
8. Mahapatra, N. R., &Dutt, S. (2007). An efficient delay-optimal distributed termination detection algorithm. Journal of Parallel and Distributed Computing, 67(10), 1047-1066.
9. Jo, J., Lee, Y. K., & Shin, H. S. (2013). Real-time analysis of heart rate variability for a mobile human emotion recognition system. Recent Advances in Electrical and Computer Engineering, 2013, 162-166.

Published By:
Blue Eyes Intelligence Engineering
& Sciences Publication