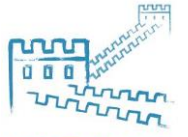


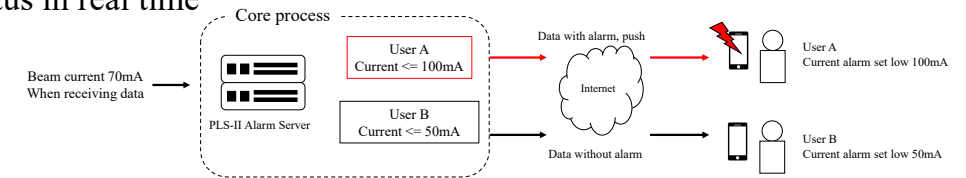
DEVELOPMENT OF ALARM AND MONITORING SYSTEM USING SMARTPHONE



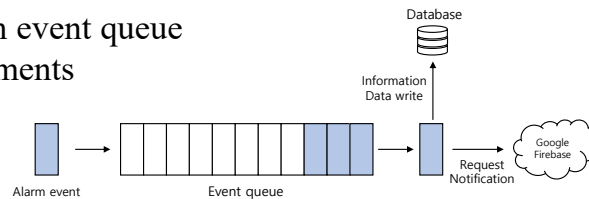
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- Designing an alarm and monitoring system using a smartphone
- Different alarm setting environment for each user
- Real-time data monitoring and line chart support
- When an alarm occurs, push the alarm to the smartphone application
- Web service support for Android and iOS

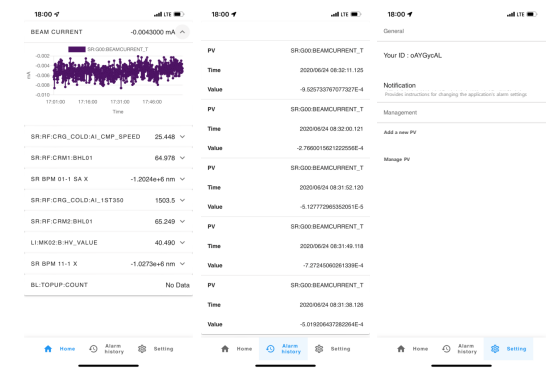
- Integrate the PLS-II accelerator's EPICS IOC system and connect to the alarm server
- Communication through a wireless Internet network such as cellular or Wi-Fi
- Check EPICS PV connection and monitoring status in real time



- Integrated alarm system core development
 - EPICS PV connection status and data monitoring
 - EPICS PV data update check
 - Alarm check through simple algorithm
 - Storing data with InfluxDB
 - Log recording and alarm push through event queue
 - Support multiple smartphone environments with Google firebase
 - Use of web socket technology



- Web service and app development
 - Implementing a web server with Node.js
 - Implementing web pages with Vue.js



Introduction

- A system using a smartphone was devised for real-time data monitoring and alarm support
- Data was collected in the developed alarm server using the EPICS system of the existing PLS-II
- The new program was developed in Java language to enable data collection and analysis to be performed, and the beam dump condition can be known
- Developed to meet each user's different alarm conditions and monitoring functions
- Users can respond quickly in emergency situations with a smartphone application
- Reading data just before the alarm

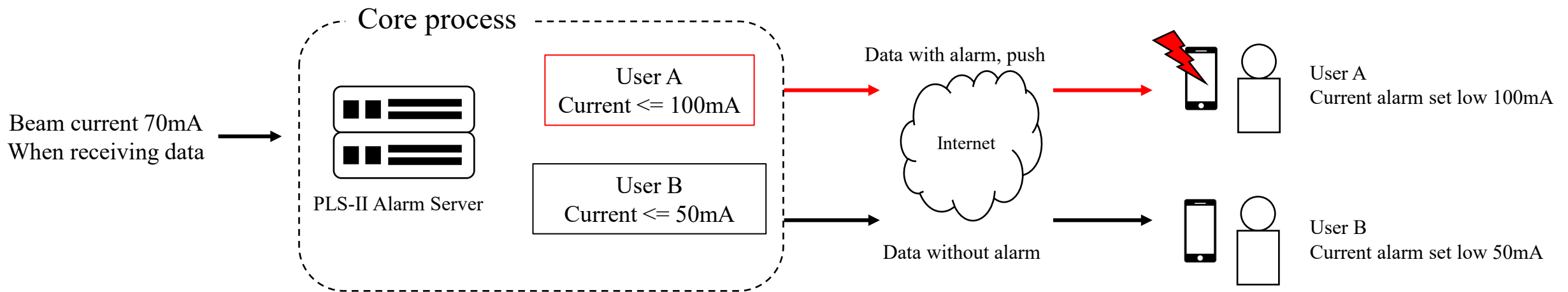


Figure 1. Alarm system operation overview

Alarm System : Integrated alarm system core functions

- **EPICS PV status**
 - If the PV communication connection state is disconnected, the IOC or internal network situation is not good.
In this case, a notification is first sent to the user so that user can immediately check the IOC status or network status
- **Data watcher**
 - Provides an alarm if the value does not change for a certain period of time according to the PV SCAN field setting of the EPICS IOC or user define time
- **Event queue**
 - As shown in Figure 2, the event queue stores the user ID, time, value, and PV name in the database when the alarm condition is satisfied based on the collected data and prepares to send an alarm
- **Alarm condition pseudo code**

```
Data stored in influxDB
if (data < low or data >= high) AND flag then
  if nowTime – lastTime > intervalTime then
    alarm push
  end if
end if
```
- **Web socket**
 - It supports sending and receiving messages freely in both directions. Therefore, it supports the ability to monitor the current PV data to the user in real time.

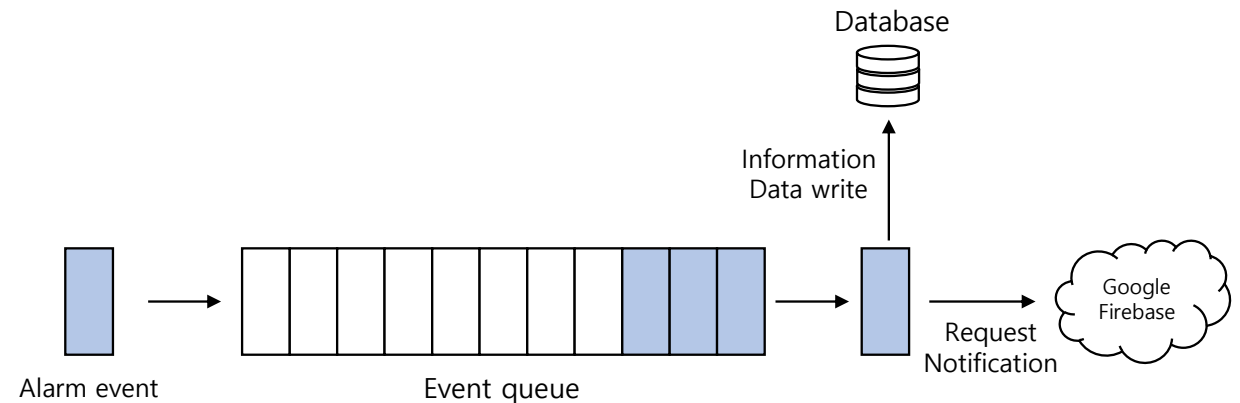


Figure 2. Event queue

Alarm System : Web application (Back-end) functions

- **RESTful API**
 - that is processed in HTTP protocol environment and performs commands such as POST and GET.
Node.js can develop programs by distinguishing POST and GET commands from the same route address.
When a user requests data, the GET function is used.
- **User register function**
 - It is registered after generating a random user ID based on the token generated by the Google Firebase library
- **Alarm history function**
 - Sends up to 5 hours of data stored on disk to users using alarm information and information stored as user IDs
- **Security**
 - When providing web services, external attacks occur, so security must be set
 - Two-way communication data must be encrypted by setting SSL (Secure Socket Layer) and WSS (WebSocket Secure) as security settings
 - it protects from external threats by altering HTTP server information and showing other server information to the attacker

Alarm System : Web application (Front-end) functions

- **Vue.js**
 - This is a front-end framework and supports SPA (Single Page Application)
- **HOME**
 - List of all PVs registered by the user and values that change in real time
 - If user select a PV name or an alias, user can check the data up to 5 hours ago in a graph
- **ALARM HISTORY**
 - The past records of alarms that have occurred to the user by alarm occurrence time, value, and PV name
 - If the user selects this list, user can check the historical data stored before the alarm in a graph
- **SETTING**
 - Change the user's application usage settings
 - When an alarm occurs to the user, it is possible to turn on/off the function that the alarm information is exposed at the top of the smartphone screen through the notification function of the application

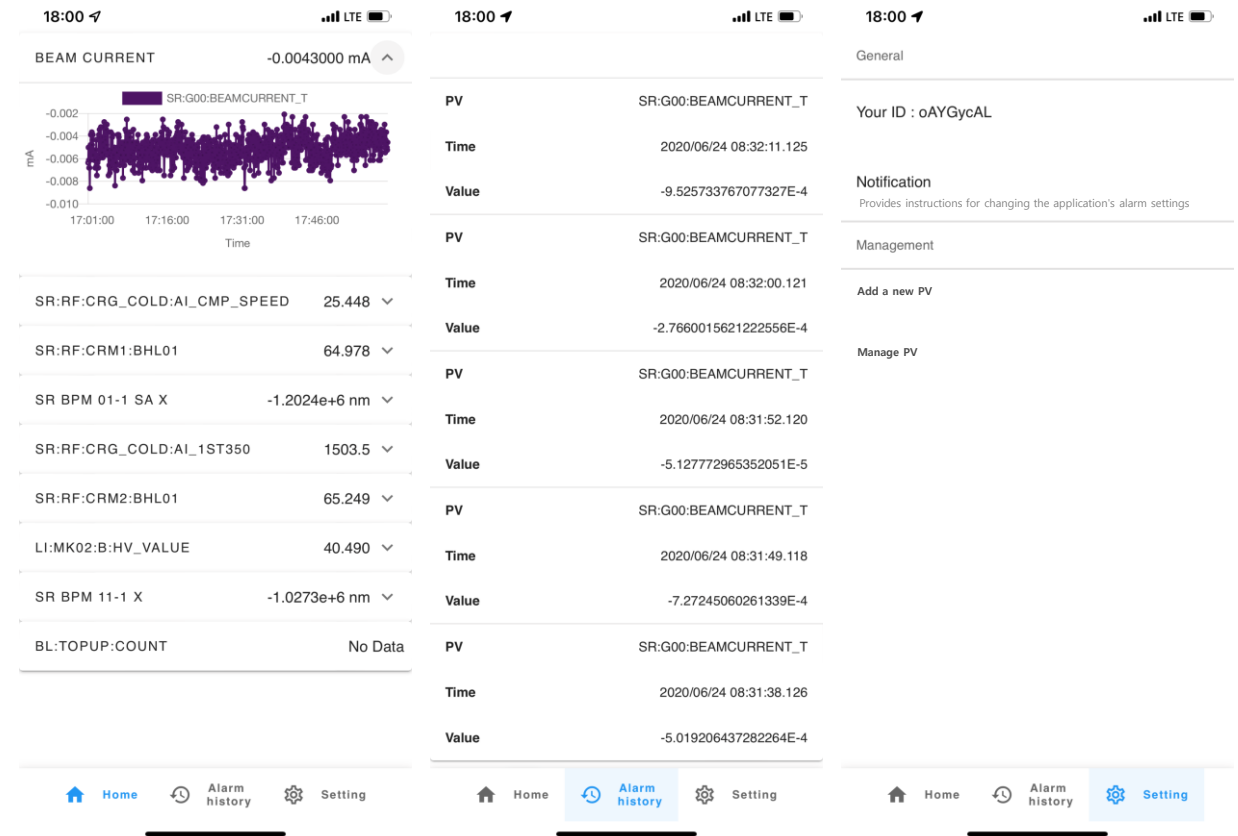


Figure 3. Smartphone Application Layout (iOS)