Development of automatic data acquisition Web application of distributed accelerometer

Makoto Furuzono[1]

[1]Tokyo Denki Univ.

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Abstract

My laboratory is developing an accelerometer. However, if you do not install the dedicated software, you can not browse the data. In addition, since it is necessary to go to the site on a semi-annual basis and collect data due to capacity problems, the current operation is burdened. In order to solve these problems, we devised WebGL that enables high-speed drawing when processing a large amount of data such as Big Data, and a Web application that uses server that can transmit, save, and download acquired data. In this application, an accelerometer and a raspberry pie are connected, and the raspberry pie receives data obtained from the accelerometer and sends the data to a server installed in a laboratory by SCP file transfer at regular intervals. These data specify the location and date from the client side through the Internet browser, download the data using the download function of the browser, read this data on the application and draw the waveform. The data obtained from the accelerometer in the development to date is converted into a CSV file and transferred to the server. These data can be downloaded and displayed on the web application. For the google map displayed on the right side of the screen, it is to make the application more useful by registering the location where the accelerometer was set in the future.

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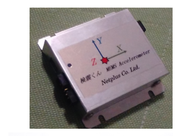
Development of automatic data acquisition Web application of distributed accelerometer

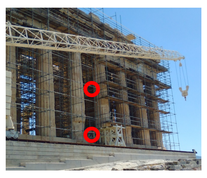
Makoto Furuzono, Yasushi Niitsu
Tokyo Denki Univ.

Purpose

- The Niitsu Laboratory is developing an accelerometer. However, dedicated software that visualizes the obtained data only works on Windows. Furthermore, due to capacity problems, it is necessary to go to the accelerometer's location every six months to collect data, which is a burden on operations.
- Essentially, an accelerometer can directly measure triaxial acceleration by connecting it to a computer. Moreover, if a power source and a network environment are prepared at the measurement point, acceleration data can be sent to another point.
- Also, to develop applications targeting researchers working at research institutions such as universities, it is necessary not only to visualize data but also to have a function that allows the exchange of data itself.
- Therefore, we developed a web browser that uses accelerometer data, WebGL that enables high-speed rendering when processing huge amounts of data such as big data, and a web application that can send and store, download the acquired data using server's technology.

Used an accelerometer



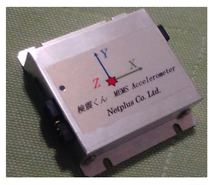


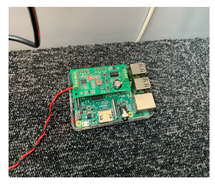
The laboratory has developed an accelerometer that can measure the acceleration of earthquake motion. Its features are

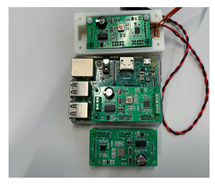
(1) Accelerometers mounted on smartphones etc. have a sensitivity that is tens to hundreds of times higher than that of acceleration sensors.
(2) The accelerometer alone can collect and store acceleration data from 3 months to 6 months.
(3) Multiple accelerometers can be operated in synchronization.
(4) The battery can be driven with low power consumption.

Etc. As far as the laboratory manages, it is installed in the five-storied pagoda in Chiba, the photo museum in Fukushima, the old private house in Saitama, etc. to monitor acceleration.

Transition of an accelerometer







- Before
- Now

Overview

- Name：

  Acceleration data curating application

- Function：

  Data is sent to the server from accelerometers, and the files can be visualized and downloaded if necessary.

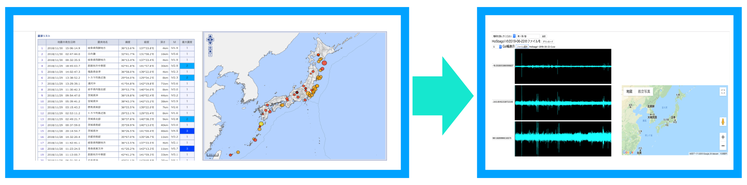
Used Languages & Teqniques

HTML CSS JS WebGL

node express

Difference from existing systems

- There are only a limited number of organizations that handle waveform data of shaking caused by earthquakes.
- Also, there are few homepages and websites that obtain data that can be handled as research through the Internet.

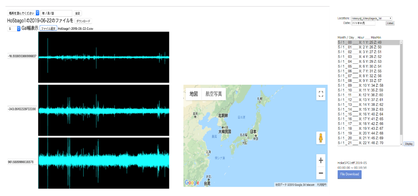


Difference from existing systems

- There is no use for ordinary people.
- Seismometers measure underground shaking, but accelerometers measure top ground and building shaking.
- Some researchers want to see the earthquake resistance of the building.
- I developed if files exist & internet connected it possible to see not only Japan but also overseas.

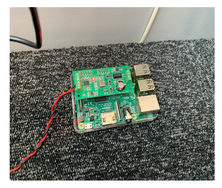
Transition of an application

- Previously, files were selected directly from the front-end side, but by selecting the location and date and making it possible to select from the list, it succeeded in reducing the trouble of searching for data and the amount of data communication did.



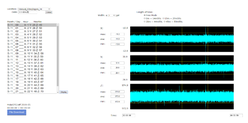
- Before
- Now
- Also, I made the screen clear by hiding the Google map, which is not always used, to the right.

Explanation of an Action



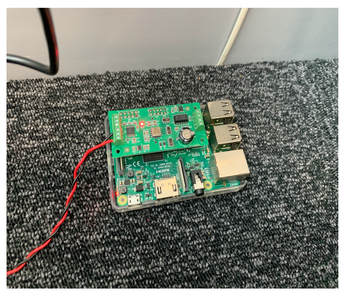
① Transfer acceleration's data

② Process an acceleration's data and move a file's position



③Display an application

Explanation of an Action①



- After the accelerometer has finished collecting data for one hour, it sends a file to the server using SCP communication.

Explanation of an Action①

- Consist of server's folder

```
../Desktop
  └ share
    ├ FukuPM2ndf_2019_07_01_00.acb
    ├ NiitsuLab_2019_07_01_00.acb
    ├ NiitsuLab_2019_07_01_01.acb
    ├ …
```

- All files sent from the accelerometer are stored in the 'share folder' on the Desktop.

Explanation of an Action②

- Consist of application's folder

```
../Acc-Base
  ├ bin /
  ├ node_modules /
  ├ public /
  ├ routes /
  ├ views /
  ├ .gitignore
  ├ app.js
  ├ package.json
  ├ package-lock.json
  └  README.md
```

- Files that are published on the Web are in "public folder", and files that are not published such as acceleration data are in "routes folder".

Explanation of an Action②

- Consist of acceleration data's folder

```
Acc-Base /
  └ routes /
    └ acc_data /
      ├ FukuPM2ndf /
      │   └ 2019 /
      │     └ Jul /
      │       ├ 01 /
      │       │  ├ FukuPM2ndf_2019_07_01_00.acb
      │       │  └ FukuPM2ndf_2019_07_01_01.acb
      │       └ List_FukuPM2ndf_2019_07.csv
      ├ FukuPMbase /
      ├ GrkPARTbase /
      ├ …
```

Explanation of an Action②

- Extract "Location", "Year", "Month", "Day" and "Width of XYZ maximum and minimum values" from the title and contents of the file.

- 例

Location： FukuPM2ndf
Year： 2019 X: 10
Month： 07 Y: 8
Day： 01 Z: 9

- Also, "width of maximum value and minimum value of each XYZ," writes data to a dedicated CSV file.

Reference

- 加速度センサー https://kotobank.jp/word/%E5%8A%A0%E9%80%9F%E5%BA%A6%E3%82%BB%E3%83%B3%E3%82%B5%E3%83%BC-13881
- スマホや自動運転に活用される加速度センサー、ジャイロセンサーとは https://smartdrivemagazine.jp/technology/accelerometer_gyroscope/
- いまさら聞けない加速度センサ入門 http://ednjapan.com/edn/articles/1205/16/news110.html