卒業論文

即時性の伴うイベントを
可視化・共有するWebサービス群

Web Services Enabling Real-time Visualization and Sharing of Information from Real-World Events

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概要

Twitter に代表されるマイクロブログの広まりやスマートフォンの普及により，ソーシャルメディアに人々の自発的で自然な反応が多く含まれていることが可能になった．本研究においても，リアルタイムの個別ユーザからの実世界のイベントに関する反応を入手し，トレンド分析やイベントの整理，共有などを行う様々なサービスを最新のサーバ技術を用いて構築した．リアルタイムな情報共有に注目し，複数のアプリケーションの作成を通し共通基盤を構築したことについて述べる．

キーワード:

ブラウザネットワーキング，マイクロブログ，人流

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Web Services Enabling Real-time Visualization and Sharing of Information from Real-World Events

Abstract

With the spread of the spread and smartphones microblogging represented by Twitter, it has made it possible that contain many spontaneous and natural reaction of people in social media. In the present study, to obtain a reaction related to real-world events from the real-time of the individual user, organizing of trend analysis and events, was constructed using the latest server technology a variety of services to perform the share such. It focuses on real-time information sharing, we describe that was constructed a common infrastructure through the creation of multiple applications.

Keyword:

Browser Networking,Microblogging,People Flow

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Chapter 1

Introduction

In this chapter, the background of this study and the purpose and describes the contents of the configuration of the present paper.

1.1 Background

Against the background of the spread and smartphones spread of micro-blog, which is represented by Twitter, it is as spontaneous and natural reaction of people is contained in a large amount in social media, has become easily able to acquire it.

1.2 Purpose

In the present study, to obtain a reaction related to real-world events from the real-time of the individual user, organization of trend analysis and events, to construct a variety of services to carry out, such as shared by using the latest server technology. Focusing on real-time information sharing, we describe that it has built a common infrastructure through the creation of more than one application.

1.3 The configuration of the present paper 成

The following configuration of the present paper is organized as follows.
Chapter 2 describes the concepts to be used in the present paper.
In the third chapter, proposed a system of improvised browser communication.
Chapter 4, describes the detection and visualization of routes and events using a micro blog.
Finally, we describe the conclusion of this paper in Chapter 6.

Chapter 2

Route event detection and visualization by the position information with Tweets analysis

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This chapter focuses on the position information with a tweet, describes the visualization technique based on Web applications of human movement path that is expected to event participants.

2.1 System summary

In this study, we focused on the position information with Discover carried out the creation of visualization and application of human movement path you think that the event participants. In addition, we describe a Web application that was created for the purpose of detection and visualization of clustering to events from the position information and tweet content.

2.1.1 Moving path visualization

Was visualization of the collected moving path a tweet from the sample as 2014 October 18, Fujisawa Enoshima fireworks [4] that have been made in days of study(graph 1). User and discoveries within a 10km radius to the fireworks display on the day as a user you think that the event participants "fireworks", "Fujisawa", were collected data to narrow down in the user who made the tweets in the main station name.

2.1.2 Event detection

Sample of the study was to collect the tweets between May 9, 2015 of around has developed a system of May 12. Was the visualization to tweets keyword and latitude, on the map and color-coded for each cluster performs a clustering longitude parameters. Also created a Web application that allows to manage and map view of clustering results(graph 2).

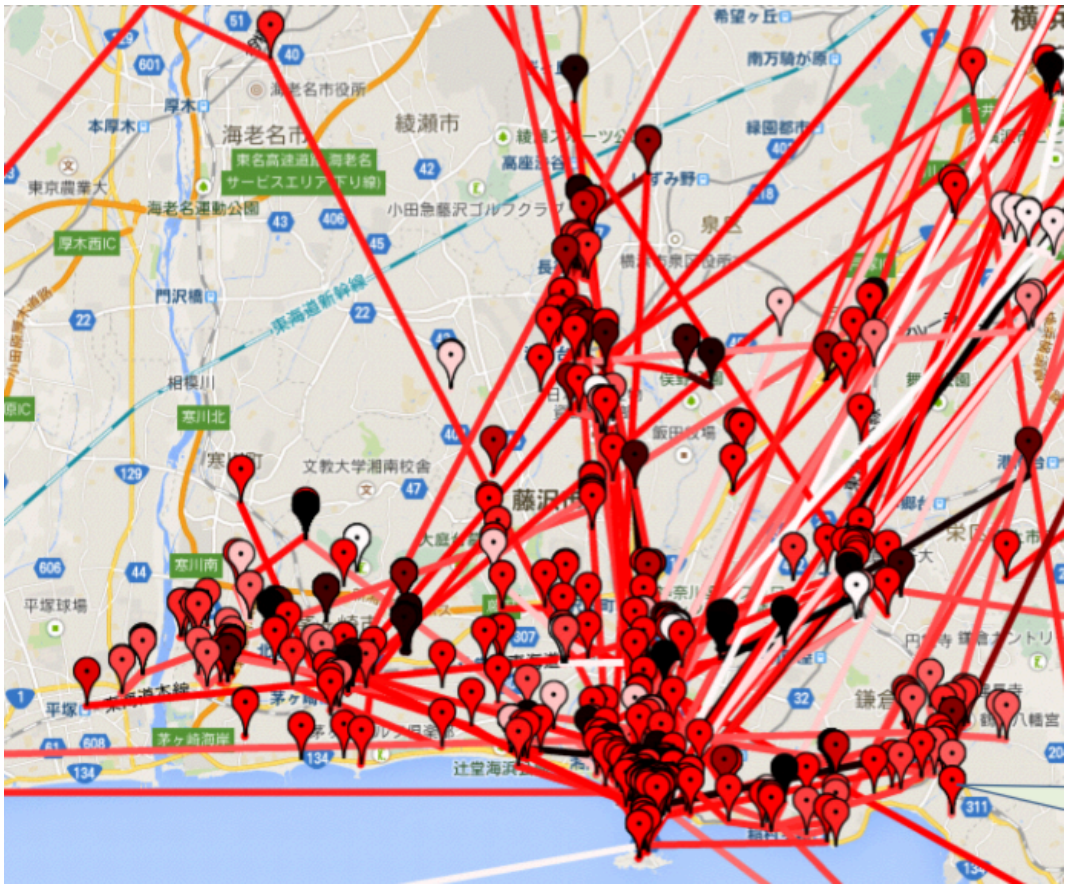

Fig. 1: Application Screen

2.2 System stracture

2.2.1 Abount Twitter API

The tweet collection of the present study was using the Twitter API. Mainly use the `https://api.twitter.com/1.1/search/tweets.json` and `https://stream.twitter.com/1.1/statuses/filter.json` was collected tweets. search/tweets API is a possible acquisition of the past tweets range specified in the past tweets search and latitude and longitude and a radius of a keyword specified as the filtering of the tweet. In addition, the past tweets by "search/tweets" there is a limit of up to a week ago.

2.2.2 Moving path visualization

To analyze the procedure in the following (graph 3).

Fig. 2: Event detection application screen

Acquisition of sample

Were acquired focused around 10km distance from the fireworks launch point of Fujisawa Enoshima fireworks. Fireworks launch point is latitude to 35.307061, longitude was 139.478704. It has acquired the tweet of the day from 17 days before and after up to 19 days for further user of the acquired tweet(table 1)

Date	Number of sample
Oct. 17	5052
Oct. 18	26723
Oct. 19	20227

Table. 1: Fireworks - Sample tweet number

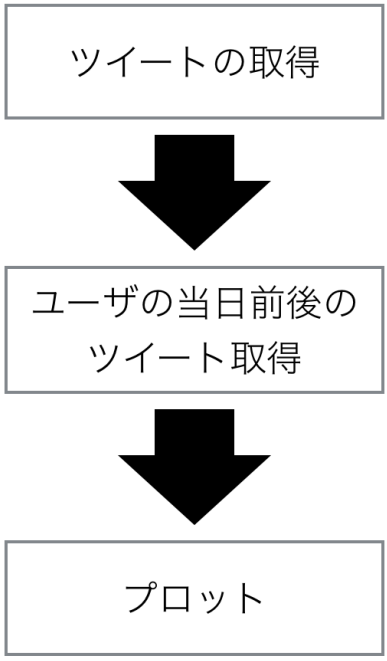

Fig. 3: Flow of fireworks Tweets analysis

Visualization Web application

The visualization was using the Google Maps API [5]. To display the marker in each tweet point, the same user displays signed before and after the tweet and the line use a polyline, is a straight line was attempted visualization of the route. The color of the marker to change the brightness with time, and the display in a dark red from bright red through the night from morning(graph 4).

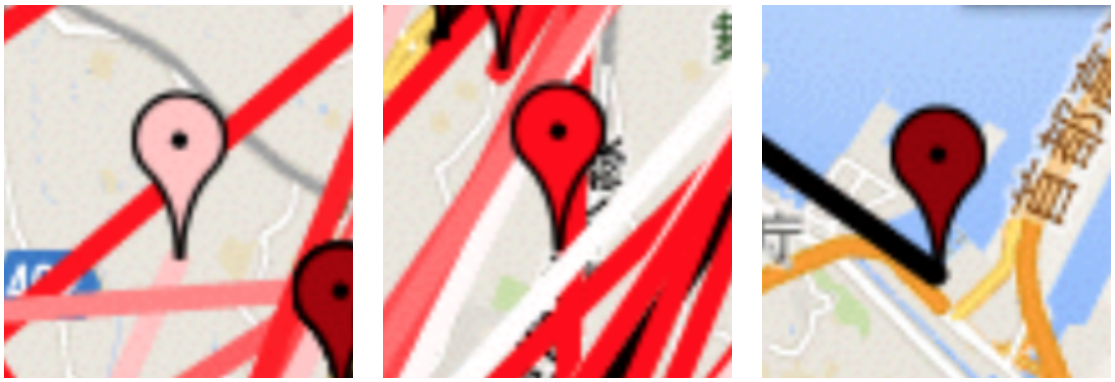

Fig. 4: From left to right, a marker of the morning, noon, night, time zone of

2.2.3 Event detection

To analyze the procedure in the following (graph 5).

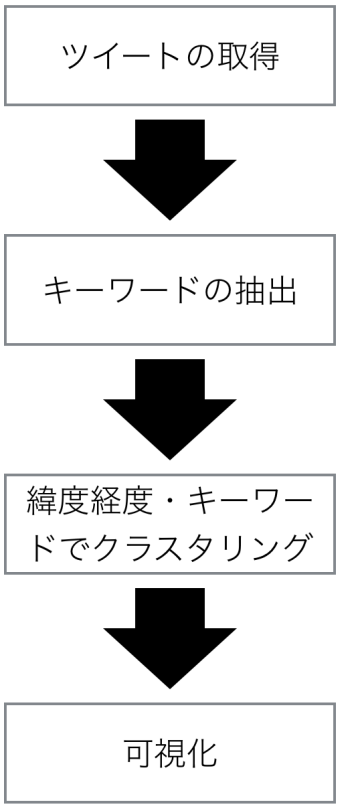

Fig. 5: Flow of event detection and visualization

Tweets collection

Discover were obtained similarly to the visualization of the movement path. This time, as a sample of the Tokyo metropolitan area of the tweet. Tokyo downtown latitude 35.673343, 100km within the longitude from 139.710388, collection date and time was 4 days of May 9 to May 12th.

Clustering

Were clustered using K-means the keyword latitude and longitude to the shaft. A result, was able to classify the number of cluster (table 2) for each date. Further, it is necessary to examine techniques since the result desired result of attempting K-means could not be obtained, including the time zone.

Date	Number of Culster
May. 09	10
May. 10	12
May. 11	7
May. 12	7

Table. 2: Event detection - the number of clusters

Visualization Web application

Using GoogleMap like the path visualization. It has changed the color of the marker in each cluster. Pick up because the good results in the result of the visualization results 10 days were obtained. 10 days clusters became list, such as follows (graph 6).

Fig. 6: Plot the results May 10

Keyword	Number of Tweets
imacoconow	264
kawaguchi	76
神田祭	65
photo	43
横浜	41
週末限定	38
神田明神	35
東京	30
天気	28

Table. 3: Event detection - May 10

Events that could be discovered by visualization

It is on 10 May shrine of Kanda Festival of events that had been understood from the previous experiment Miyairi has been carried out throughout the day. It was actually able to detect the tweets around events [6]. In addition, has also been events that did not run in advance on the same day "野外音楽フェスティバル 人間交差点 2015 [7]", it can be said that here also could be detected as tweets around events.

Fig. 7: Plot of Kandasai Tweets

Fig. 8: Plot of nkfes Tweets

2.2.4 Geo Tweet collection client

We have created a Web application that collects in bulk tweets with location information as a tool to collect the Tweet in this study by using the API (graph 9). In applications to get a recent tweet, it is expected to take advantage in future research.

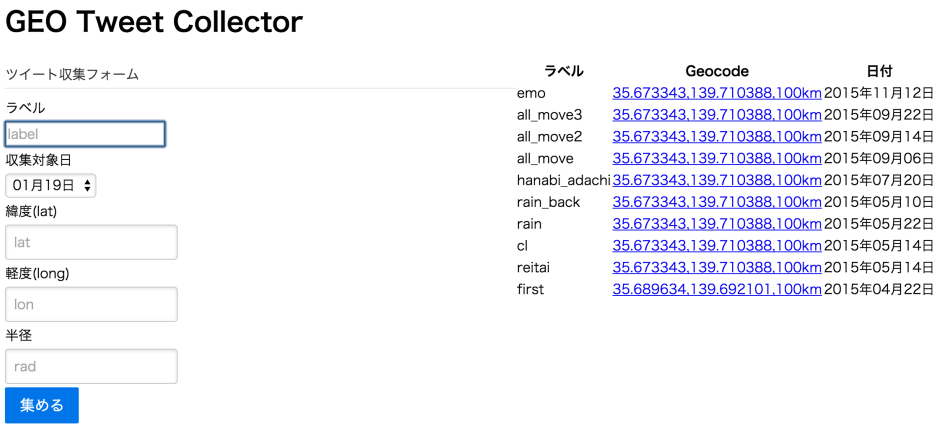

Fig. 9: Tweet collection application UI

2.3 Conclusion of this chapter

As a result, although it is such speculation stations that are key to use from the visualization, the moving source and the human flow of only the information obtained in the collection to join each user it could not be predicted only roughly.

As a related study, information adding approach to Discover no location information have been proposed[3], the analysis can be expected with respect to the increase and the user information by utilizing.

Because the current is not able to attribute pickled user, I want to try or not find any significance in the visualization in the future and the additional information. Clustering, including the time axis is also considered to be involved in the detection accuracy of the event. Visualize using the animation is also believed to have spread the possibility of representation.

Chapter 3

Browser networking game infrastructure that can be improvised and number of team play

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In this chapter, we describe a browser capable of networking game is improvised multiplayer play that was created.

3.1 Background and summary

In recent years, real-time communication technology has been attracting attention by WebSocket [13]. There is a need to work efficiently use the communication tool in many of the technical positions. It to the background, the study of real-time synchronization WebGL technique suggestions [8] and Web desktop sharing of using WebSocket [**?**] is being carried out in joint research. Moreover, against the background of the widespread use of smart phones [11], take advantage of the QR code [12] has also penetrated, recognition rate of QR code reader is a more than 90%, finding that use experience rate is about 70% are out [10].

We focused on immediate establishment of a connection where the smartphone with the controller. And by the creation of immediate participation capable browser application, describes the proposed information sharing method based on smart phone using the QR code and WebSocket[**?**].

3.2 System summary

As an example with the creation of the game platform, it was the creation of a multiplayer-enabled browser shooter. QR code as the (graph 10) is displayed when you start the server to access from the monitor terminal to the game page in a browser. Players who play in the same screen can participate in the play can be accessed by the QR code read by smartphone terminal to the URL for the controller.

Controller is a horizontal possession smartphones, shake (shake the smartphone) was placed in the game as the input also like behavior (graph **??**)controller). Immediate participation in the smartphone by using a socket communication [17] can be a real-time operation of the player can be.

3.2.1 Game system

The content of the game will be explained.

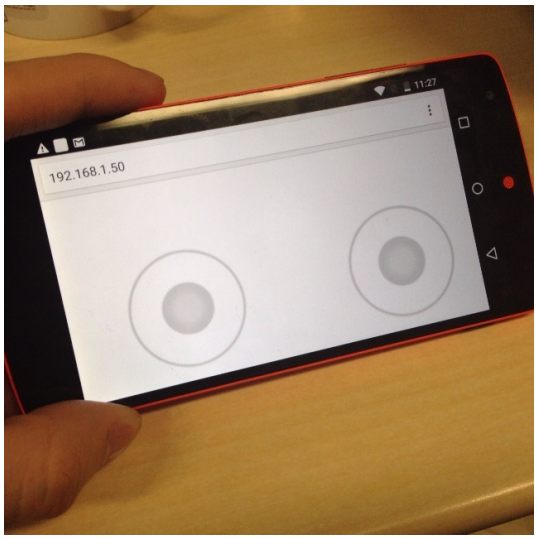
The game was to create a plane of the shooting game. Section, consisting of the wall can be moved on the stage is the player (graph 12) object can not pass through (graph 13). Players have an HP (Hit Point), MP (Hit Point), consume MP to shot attack, it consumed MP is MP and get scattered to the map was added to the rules of the feature of recovery.

Action of the player can be done, but three of the move and shot attack and dash. Shot in the controller right, shot in the controller left attack, dash can be in the shake.

It was consideration of the processing speed for the number of players. It was performed regression analysis taking the connection number and FPS about creating

Fig. 10: Authentication QR code

the game (graph 14). Some display was the state are heavy in seven of 28.28fps at the time of connection



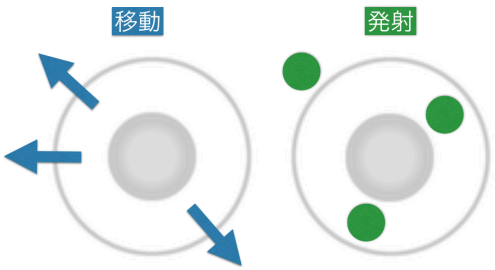


Fig. 11: Controller, controller of the description

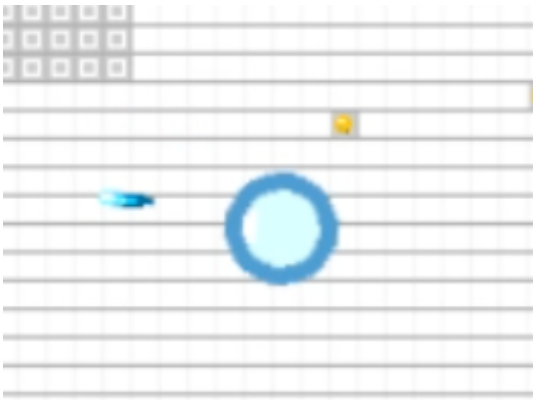


Fig. 12: Player, Shot

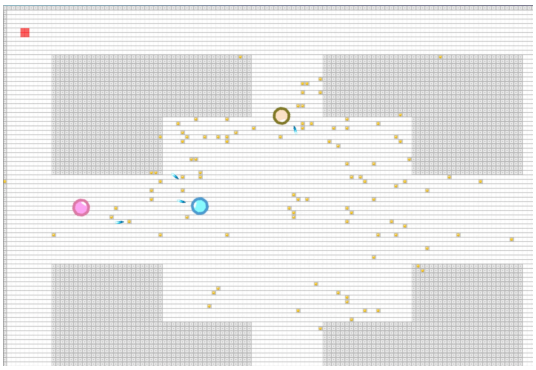


Fig. 13: Game screen

3.3 System structure

3.3.1 Diagram

The configuration of the system will assume the two, and the configuration shown in (graph 15) move and operate the online server, the configuration shown in (graph 16) like can play only in the local network by to make a server on the PC.

3.3.2 Flow of network communication

To establish a connection in the flow (graph 17), such as:

- To access the main page from the terminal as the display. (1, 2)

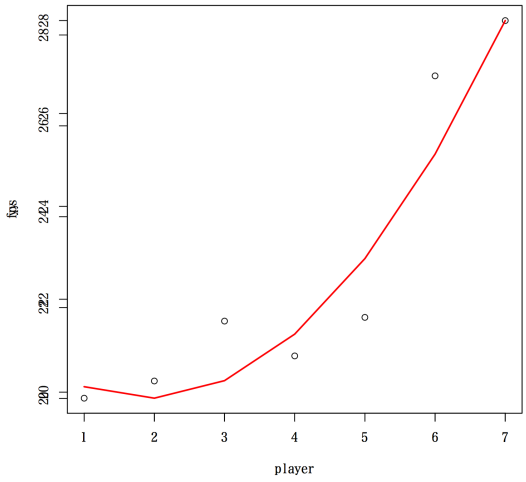


Fig. 14: FPS Graph

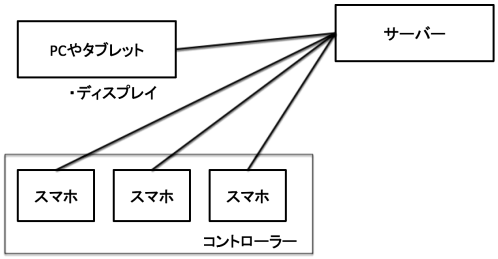


Fig. 15: System configuration

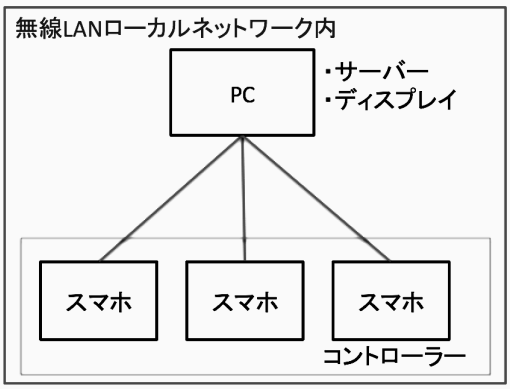


Fig. 16: System configuration2

- To establish a socket connection at the time of the response. (3, 4)

It is to play until the preparation of the game screen do the following such communication (graph 18).

- Clients access to the team selection page (/con). (1, 2)
- To access the team to the selected completion page (con/team=), to establish a connection of the socket. (3, 4, 5, 6.)
- To send additional information to the display terminal or other users. (7).

Game-time communication is sent to the client that opened the main page through socket for input of a controller as shown (graph ??)nodegame), it is synchronized with the player's actions.

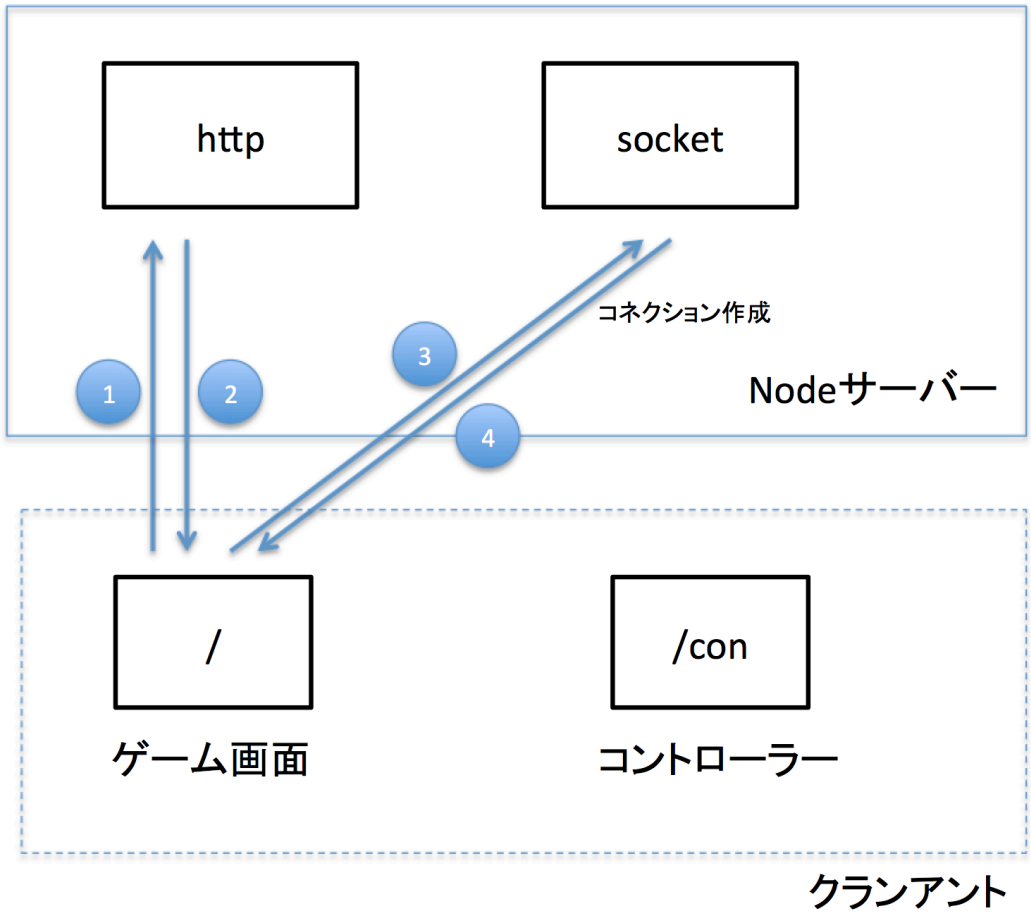


Fig. 17: Communication at the time of the main page connection

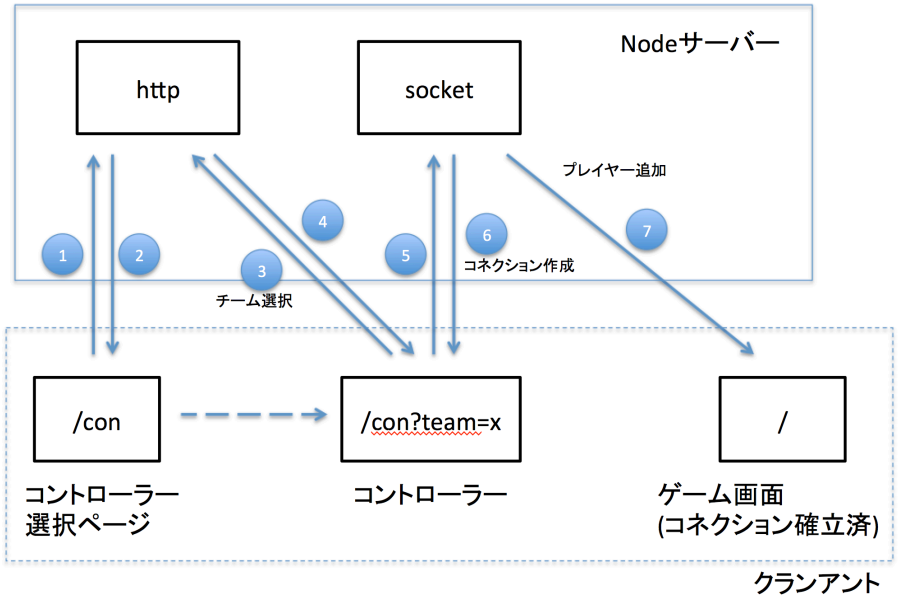


Fig. 18: Communication at the time of the controller connection

3.4 Conclusion of this chapter

Figure how you are playing the game To me it shows (graph **??**). Game freeze occurs this time made the game is about once in 20 seconds in connection with four people, was seen constantly Kaku with that's connected in eight. If the data to be handled in the socket is simple is believed that can improve the performance of.

The system made a demo and poster sessions presented at the University of the open campus and academic. Although many of the participants were able to participate in its own smart phone, the case of QR code reader app is not in the terminal occurs in one percent or less. Considered and evaluation of packaging and network load as the starting point and the game framework for future development.

The application of this system, a general purpose of the server-side, a library can be expected. It seems to spread the possibility of communication to the mobile terminal in such there is no network environment affected areas by blowing the Wifi if it is possible to perform also porting to RaspberryPI.

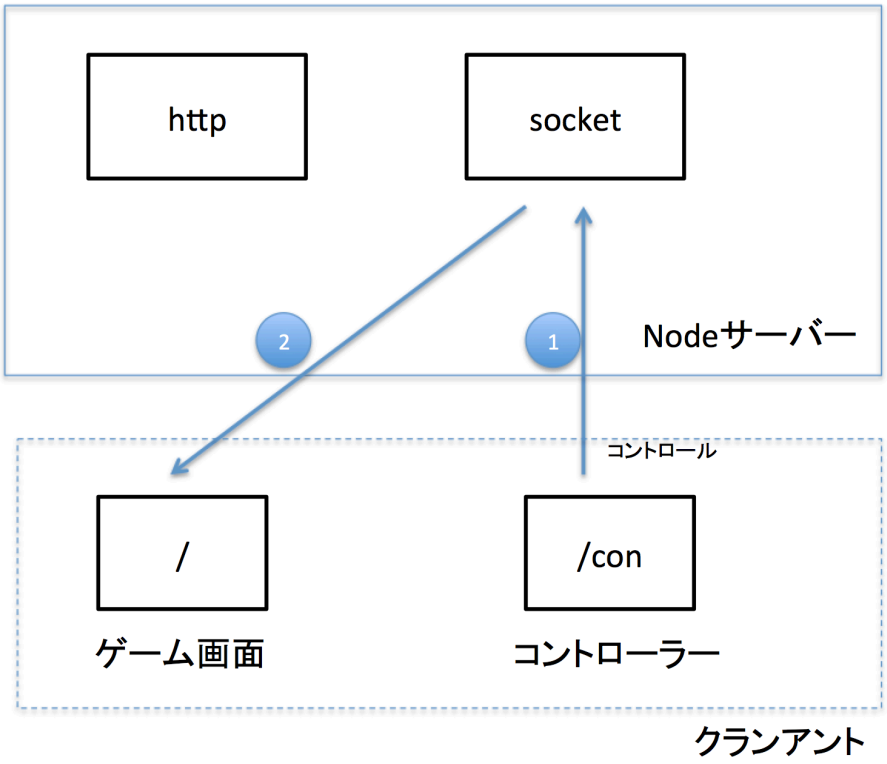


Fig. 19: Synchronization control query at the time of the game

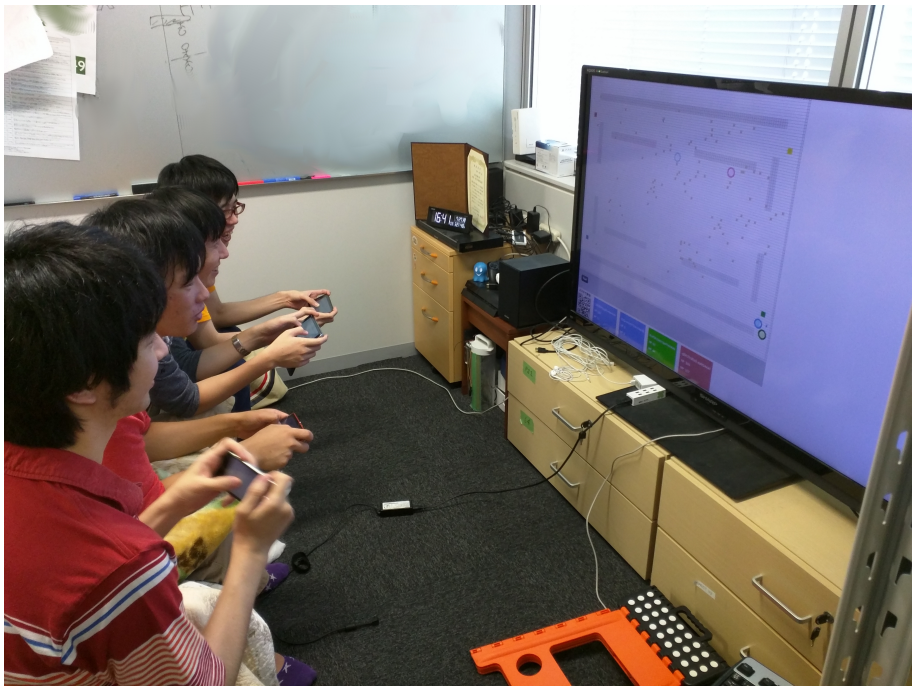


Fig. 20: State of play

Chapter 4

Extraction of the local trend of Twitter

It describes the study of the real-time trend analysis techniques within a particular cluster in this chapter

4.1 Background and related research

The society has a variety of organizations and groups, there is a news and trends in the interior. In addition, Twitter has been actively used as a tool for the event acquisition of real-time information and progress. As related research, proposals and of the events of the congestion situation grasp by tweet analysis [19], have any other suggestions of the analysis method of forecasting and will trigger things trend [20]. We tried to extraction of the local trend keyword by the analysis of this time Tweets by university students.

4.2 System summary

As a sample, was registered at the user has been self-application and manual, the aggregate to target university students of Twitter user a total of about 600 users of the tweet, the extraction of keywords that are prevalent in the immediate vicinity of the time zone application the implemented. To do the statistics every hour, to the post from Twitter of bot [1] the top keywords as a trend(graph **??**) [21].

4.3 Algorithm

The evaluation of the trend using the proprietary algorithm as shown in (graph 22). Simply calculate the frequency of occurrence of the keyword First, the adjustment of the point by the number of users, carry out the removal of the noise the point of the words you accumulated and recorded trend of recent one day as a negative evaluation. A result the upper six stars of the tweet, the point is keep a record in the database is divided into the log and cumulative for the next evaluation.

Fig. 21: Twitter bot account that you created in the experiment

[1] Twitter account that is running as an Internet bot

And mounting a plurality of the following functions also discussed delivery of as a trend content of.

- The 1st and the delivery of one week of trend
- Additional features of the keyword dictionary by reply
- Display of trend-filled in a continuous

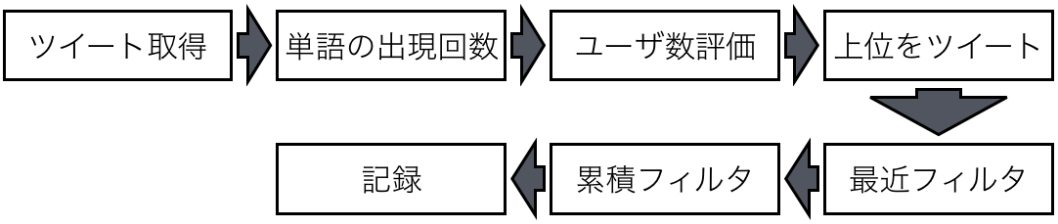


Fig. 22: Flow of analysis of trends

4.4 Conclusion of this chapter

As a result of experiments with extracts of trends in this technique, it was possible to extract the information in the news on Twitter sporadic occur in actual campus, as shown in figreftrendsample0. A result of the overlap in words that are posted as a trend in Twitter official was also seen many (graph 24). In addition, less likely to be such a special proper nouns from the sweetness of the space between words accuracy of sentences informal extraction, keyword of hash tags that are extracted reliably in opposite is the improvement tend to point is biased high.

For the delivery of at bot to be limited representation, it was also carried out implementation of the web site, as shown in (graph 25) [22]. The introduction of the evaluation to put the emphasis on local characteristic keywords not only in the cluster, statistics by the evaluation of emotion, is considered the development of such a result display on the Web site.

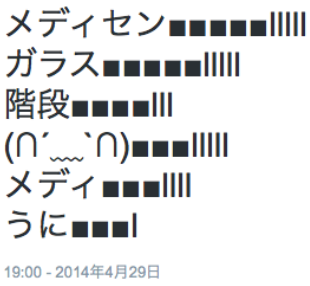


Fig. 23: Examples including sudden information that occurred on campus

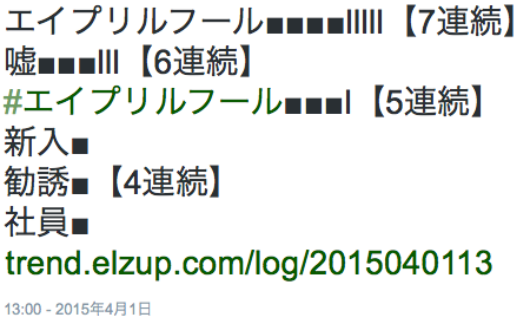


Fig. 24: Example of the overlap with the Twitter official trend

Fig. 25: Trend aggregation Web page

Chapter 5

モバイル端末センシングサーバAPI

本章ではモバイル端末に付属のセンサで収集したデータのログを管理するためのサーバアプリケーションの作成について述べる.

5.1 背景と関連研究

様々なセンサが付属するスマートフォンの普及を背景に，一般ユーザのスマートフォンを用いたセンシングの実現が期待されている [24]．今回，複数の研究やプロジェクトでの使用と複数のユーザによるセンサ情報管理を目的とし，ユーザ参加型センシングを実現に必要であるサーバアプリケーション，Web API の作成と Web 画面での管理アプリケーションを作成した．

5.2 システム概要

サーバに保存するデータ構造を (graph 26) のように定義した．今回は Project 別の管理を目的とし，Project と User は一対多とした．モバイル端末側のクライアントアプリケーションでは，「プロジェクトのユーザを作成し発行」と「ユーザのセンサ情報を追加」を行う 2 つを用いることで単純なセンシングアプリケーションを作成する事ができる．管理画面はシンプルな UI にし，ユーザ毎やプロジェクト単位でのデータエクスポートを管理画面から行えるようにした (graph 27)(graph 28)．収集したデータの分析のために CSV と KML のフォーマットでのエクスポート機能を実装した．KML は Google Earth や Google Maps でサポートされていて分析に有効である．Google Earth を用いた出力として (graph 29) と高度情報を表示した (graph 30) を示す．

Fig. 26: サーバで扱うデータ構造

Fig. 27: プロジェクト一覧の管理画面

CityWalkersMeter 管理画面 projects users logs questionnaires

Users [Project:]

Display Entries

UserID	ProjectID	Created at	Log num	show logs	download		ma
254	99	2015年12月19日(土) 15時18分29秒	799	logs	CSV	KML	Sh
256	99	2016年01月03日(日) 06時58分12秒	1590	logs	CSV	KML	Sh
257	99	2016年01月03日(日) 08時11分47秒	1823	logs	CSV	KML	Sh
258	99	2016年01月03日(日) 18時38分00秒	3749	logs	CSV	KML	Sh
259	99	2016年01月15日(金) 23時48分40秒	636	logs	CSV	KML	Sh
260	99	2016年01月15日(金) 23時52分37秒	1013	logs	CSV	KML	Sh

Fig. 28: データのダウンロードなどを行える User の管理画面

Fig. 29: Google Earth による可視化と分析

Fig. 30: 高度情報の可視化

Chapter 6

GPS 経路ノイズ除去

本章では **GPS** のデータのログにおけるノイズフィルタリング手法の提案について述べる.

6.1 背景と関連研究

GPS 技術は実時間の高精度な測位を可能にした技術であり，多様な分野で活用されてる．一方で GPS による測位誤差についての問題も広く知られている [23].

6.2 サンプルデータ

実験には移動距離が長く，特殊な動きをするスキーで記録したデータをサンプルとして用いた．(graph 31)3 日間のスキーデータのうち，2 日目のデータが特にノイズの見られた．5 秒間隔でログを記録した GPS データ 1963 個を使用する．サンプルデータらからは (graph 32) のような GPS のノイズが見られた．

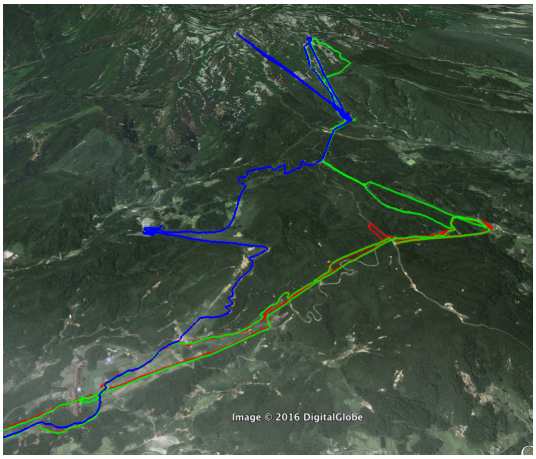


Fig. 31: スキーでの取得データ

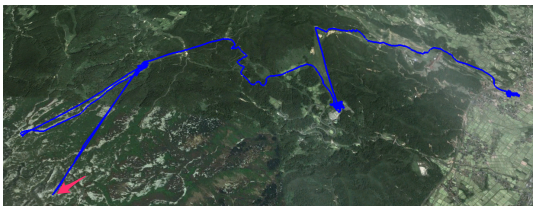


Fig. 32: GPS のノイズ

6.3 アルゴリズム

データは一定間隔で記録しているので，連続したデータの 2 点間の距離の大きさから速度が求まる．明らかに不自然な速度で移動したとみなされるデータの削除を行う．手順は (graph 33) のように行う．また，距離の計算にはヒュベニの公式を用いた．2 点間距離の降順に上位の割合をしきい値としてマップにプロットし，評価を行った

6.4 実験結果

30%，10%， 2% を誤差データの割合としてフィルタリングした結果を (graph 34) と (graph 35) に示す．特に大きな誤検知データの除去は行うことが出来た．しかし，(graph 36) に示すような屋内での GPS ログの誤差はカバーできなかった．

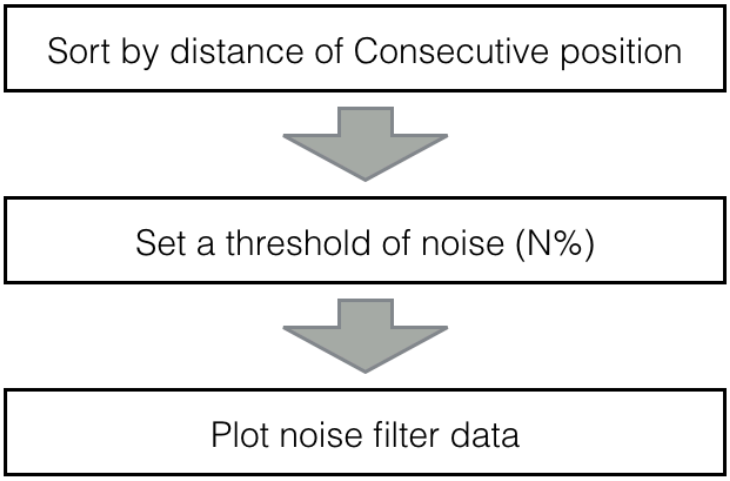


Fig. 33: 提案フィルタリング手順

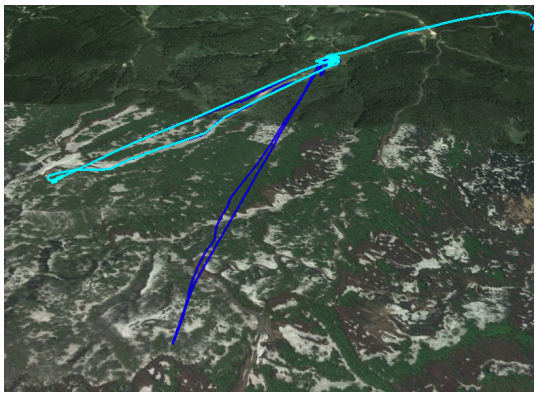


Fig. 34: フィルタ後のデータ，青: フィルタ前，水色: フィルタ後

6.5 本章のまとめ

しきい値をノイズデータの割合として定める事によるフィルタリング手法を提案した．GPS 情報には高度，や精度の情報が付加されているためそれを踏まえた手法の改善などが考えられる．また，フィルタリング処理によりサンプルのデータ数が減ってしまうのは改善点であり，データクレンジング処理も考案が必要である．

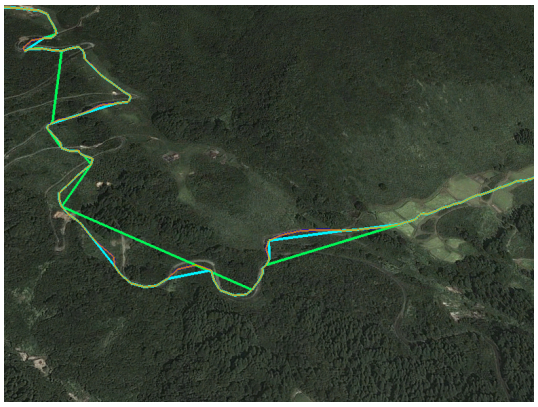


Fig. 35: フィルタ後のデータ 2，黄緑: 30%，水色: 10%, 赤: 2%

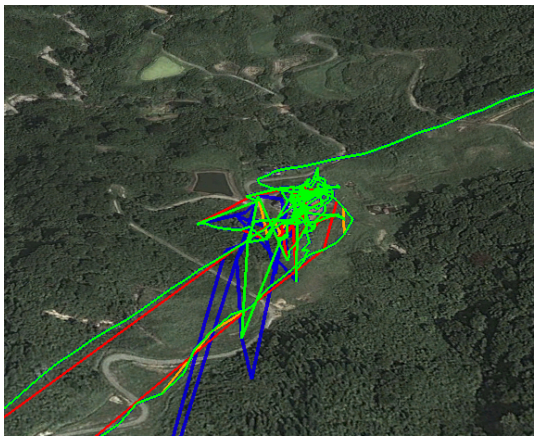


Fig. 36: 屋内でのデータフィルタ結果，青: フィルタ前，赤: 30%, 黄緑: 10%

Chapter 7

おわりに

本章では，本研究で得られた結果をもとに，結論を述べる.

7.1 まとめ

Twitter に代表されるマイクロブログの広がりやスマートフォンの普及により，それらをインフラとして人々の生活を変えより利便性を向上にしていくにはサーバサイドの技術が必要不可欠である．本研究においても，リアルタイムの個別ユーザからの実世界のイベントに関する反応を入手し，トレンド分析やイベントの整理，共有などを行う様々なサービスを最新のサーバ技術を用いて構築した．

7.2 今後の課題

我々は本稿で紹介した，即時スマートフォン参加アプリケーション，トレンド配信 bot，参加型センシングサーバ API を拡張し実運用やユーザ評価などを通して Web サービス群の最新の情報可視化共有基盤をさらにオープンソースなどを通じて広めていく．

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髙橋洸人

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