# GINS - AN APPLICATION FOR REAL-TIME GEOGRAPHIC INFORMATION SHARING

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## ABSTRACT

*This paper introduces a geographic information sharing application on android named GINS, developed by the authors. GINS create a space for sharing information on everyday issues such as traffic, accidents, social order ... GINS allow community of people, managers and geographers with IOT devices sharing information associated with geographical location. GINS also support decision-making for managers and executives through spatial analysis problems from data collected by GINS*.

## 1. INTRODUCTION

Traffic problems is the big issue that we have to face every day. It makes us losing a range of our time and money. Our idea is that develop a network that help the drivers share the real time traffic information such as traffic jam, accident ... An inform will be shared to the people nearby that problem. The collected data will be process on QGIS and then publishing for everyone see that where the accident usually happening or when and where traffic jam could happen. Data also be published for the students and researchers aim to study. There were a lot of accidents every year, but we cannot have data for our study because of the manager data of the government. Therefore, we rarely see warning map for the drivers.

GINS allow community of people, managers and geographers with IOT devices sharing information associated with geographical location. This information will be authorized and validates proof of location. The goal of the project is created an ecosystem space that have ability learning, predicting, suggesting the real-world problems from the information that was collected by the citizens and sensor devices contribution. Users through the system can get the information such as social status, traffic status, weather status… and receive AI's recommendation around their location.

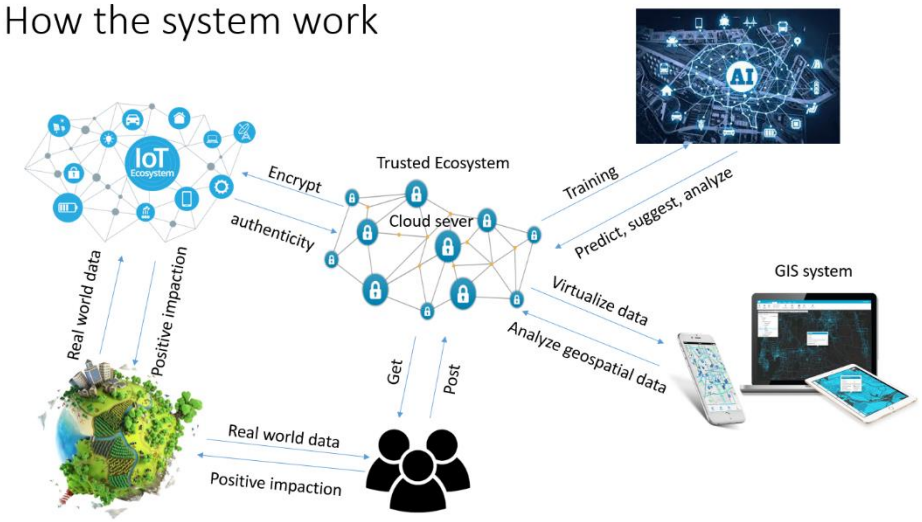



**Figure 1: GINS overview**

The objectives of GINS are to:

- Collect data from real world such as human social problems from users and world nature information such as temperature, humidity, weather … from sensor devices.
- Process data by expert geographers and data analysts
- Training data by machine learning system.
- Recommend, predict life trend of the area where user living or intending move to.

GINS has 4 modules:

- Application for users that was developed on android devices like smart phone and tablet.
- Web admin for the managers
- GIS module for the GIS expert
- Processing traffic images and train the network to predict traffic jam.

## 2. METHODOLOGY

System data flow

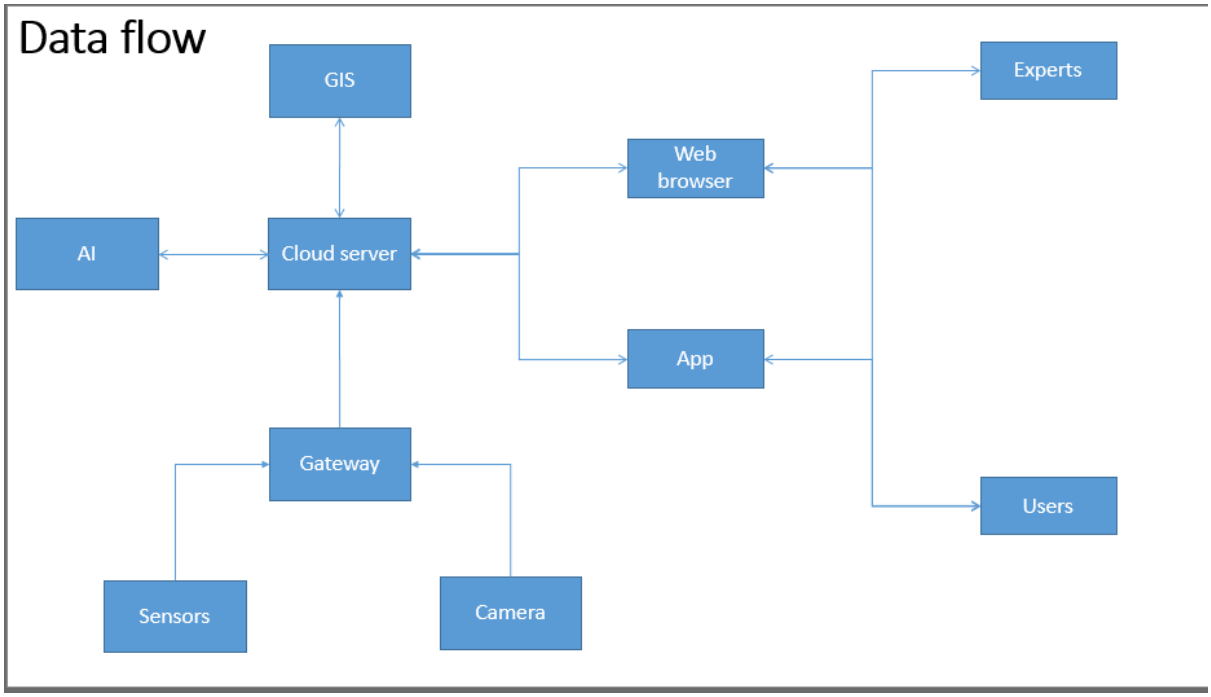
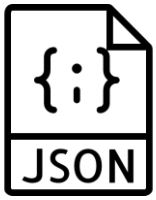
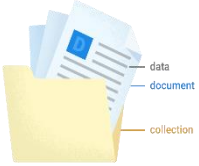



**Figure 2:** Ecosystem data flow

### Database Structure

All of system data will be structured following JSON format. It allows the system to have a flexible data structure storage. It also makes the query and transform quickly data between server and client.



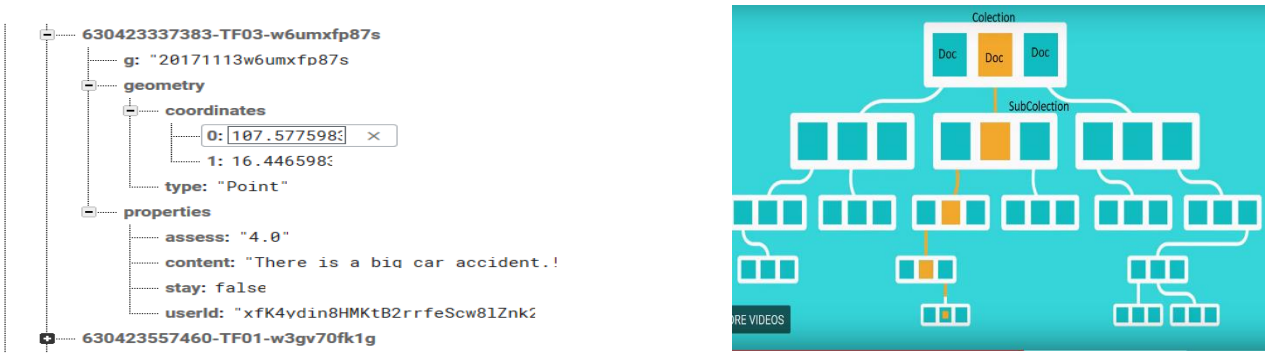



**Figure 3. Database Structure**

## Data Collection

The data be collected by users, geographers, managers and IOT devices such sensor (temperature, humidity, CO2 … was located around the city with its location and transmitted to cloud server via internet), camera setup along streets, …

## Android application

We use android studio to build android application and use google map API to get base map for the app. Mobile app used to collect data from the sharing of users. Using app the drivers can share traffic issue that could contain photos, time, locations…

When a user notice that the traffic was not good. That information will be informed immediately to nearby users.

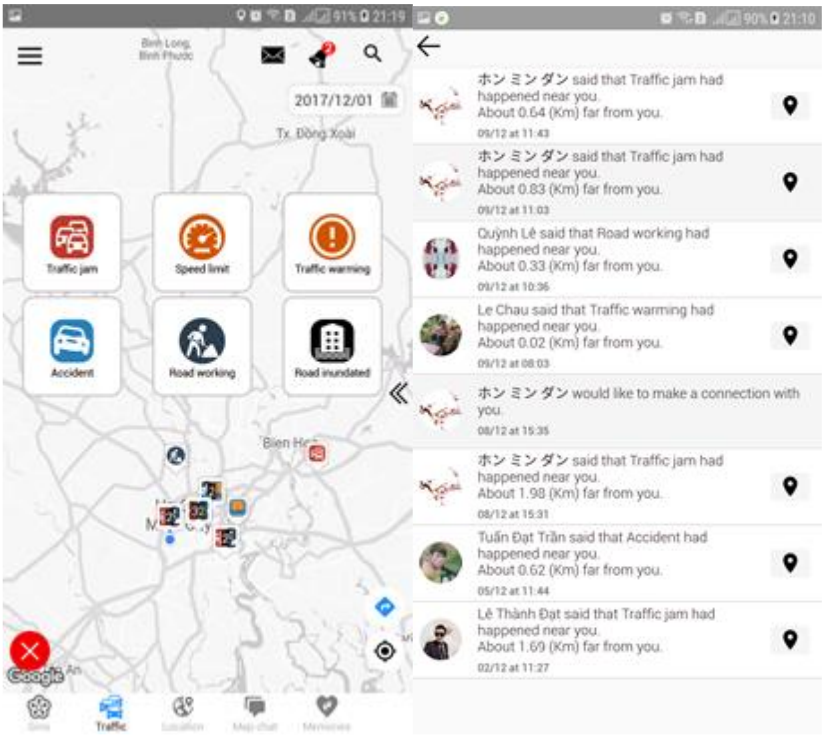



**Figure 3. GINS android app**

**Geohashes**

The research used Geohash algorithm to encode Geolocation from latitude and longitude to a string. A geohash is a convenient way of expressing a location (anywhere in the world) using a short alphanumeric string, with greater precision obtained with longer strings.

For example: A with location (10.8932, 106.78625) will be convert to "w3gvvzp3".

A geohash actually identifies a rectangular cell: at each level, each extra character identifies one of 32 sub-cells.

The cell sizes of geohashes of different lengths are as follows; note that the cell width reduces moving away from the equator (to 0 at the poles):

| Geohash length | Cell width | | Cell height |
|---|---|---|---|
| 1 | ≤ 5,000km | × | 5,000km |
| 2 | ≤ 1,250km | × | 625km |
| 3 | ≤ 156km | × | 156km |
| 4 | ≤ 39.1km | × | 19.5km |
| 5 | ≤ 4.89km | × | 4.89km |
| 6 | ≤ 1.22km | × | 0.61km |
| 7 | ≤ 153m | × | 153m |
| 8 | ≤ 38.2m | × | 19.1m |
| 9 | ≤ 4.77m | × | 4.77m |
| 10 | ≤ 1.19m | × | 0.596m |
| 11 | ≤ 149mm | × | 149mm |
| 12 | ≤ 37.2mm | × | 18.6mm |

Nearby locations generally have similar prefixes, though not always: there are edge-cases straddling large-cell boundaries; in France, La Roche-Chalais (u000) is just 30km from Pomerol (ezzz). A reliable prefix search for proximate locations will also search prefixes of a cell's 8 neighbours. (e.g. a database query for results within 30-odd kilometres of Pomerol would be SELECT * FROM MyTable WHERE LEFT(Geohash, 4) IN ('ezzz', 'gbpb, 'u000', 'spbp', 'spbn', 'ezzy', 'ezzw', 'ezzx', 'gbp8'). Whether this would offer significant (or any) performance gains over a latitude/longitude bounding box search I've yet to check (1).

**Data Analysis**

Geographers have chances connecting to the server getting the data to their local machine. In the QGIS software, experts will use python console to write the code connect to GINS server and get data. The experts will know the frequency of traffic jams, accidents, or social problems around a specific location with a timeline. The experts will export new data and his analyzed to the server.

**Training data with machine learning algorithm**

The most importance of GINS ecosystem is machine learning from GIS data. The results indicate to know where the good place for our living. Where are the area which have

good social state for our children? Which is the good way to go to our company in rush hour… to do that we have to learn the real data that was received from IOT devices and users.

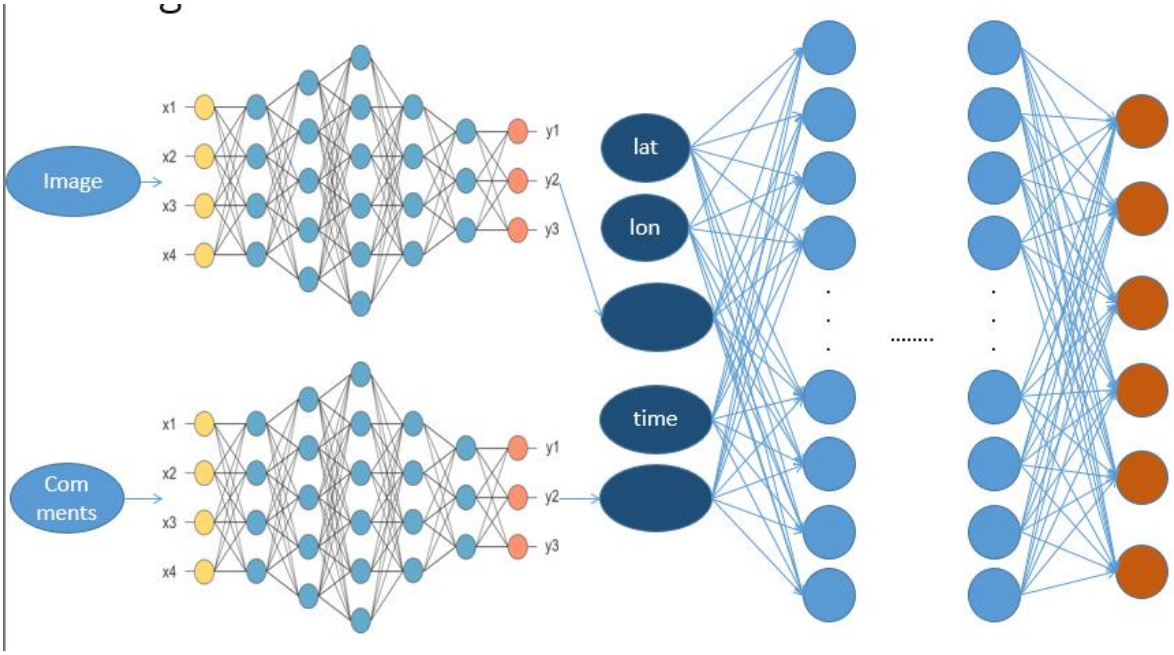



**Figure 4. Training data with a deep learning network**

i. Data

Over 3000 traffic images from 15 cameras around Ho Chi Minh City have been collected. Over 2400 images are used to train the neural network and 600 images to evaluate how accurately the network learned to classify images. All the images have been resized to 64x128 pixel. The outputs are 5 level of traffic condition. From 0 to 4 the traffic condition are no transportations to traffic jams.

ii. Algorithm

The opensource TensorFlow is used to trains a neural network model (include 3 layers) to classify images.


**Figure 5: Training result with the accuracy is 0.9211**

## 3. RESULTS

Create a neural network model that allow to feed new traffic image and then export an result of traffic condition.


**Figure 6. The evaluate of some traffic images**

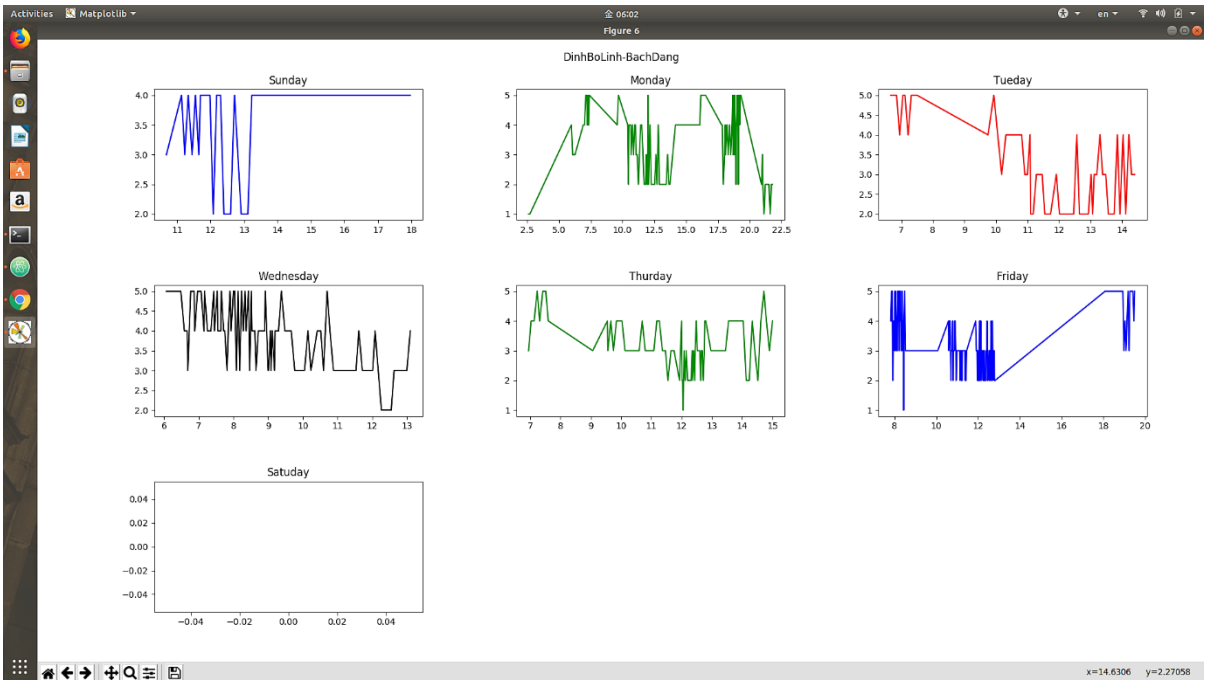



**Figure 8. Trend of traffic in a location with a camera observer**

Create an appliction that allow user sharing traffic condition, social problems or other facter to the community.

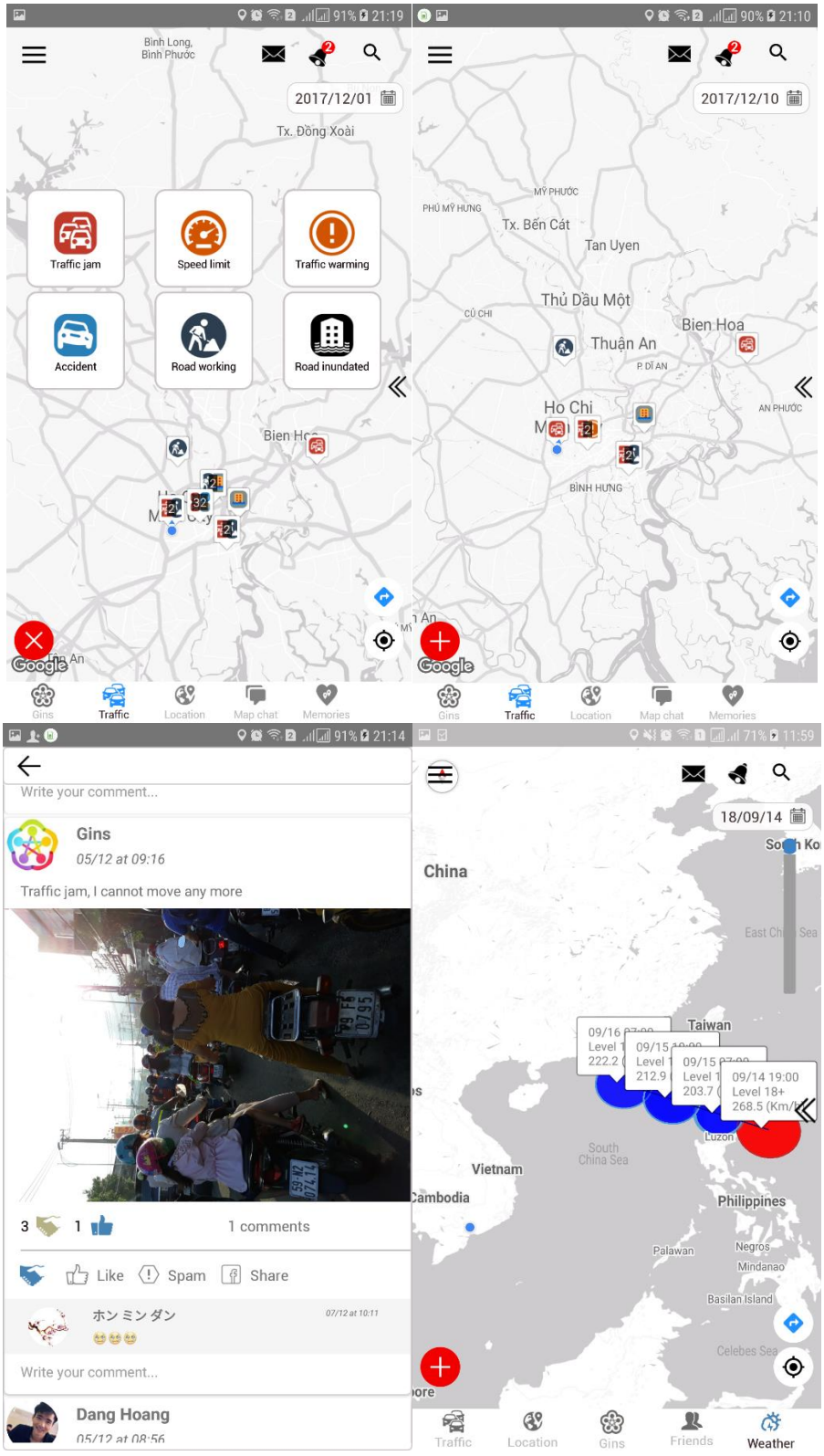



**Figure 9. GINS application**

Analyze data on QGIS software that showing the frequent of information that was reported by users.

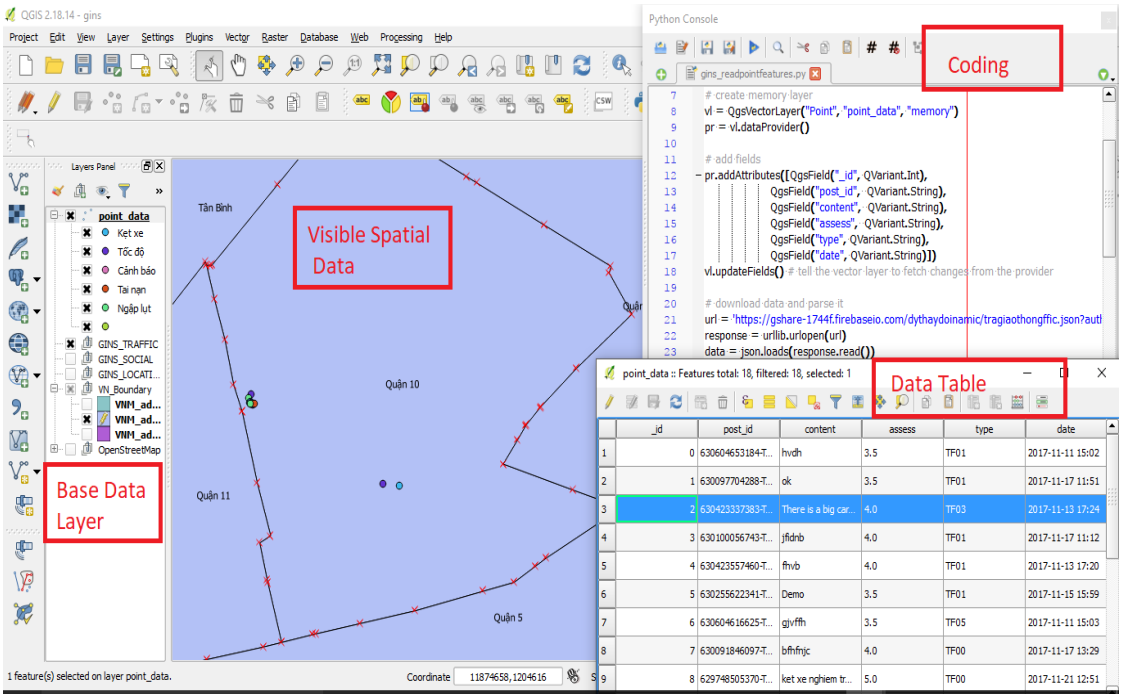



**Figure 10: Visual data in Qgis and analyze**

## 4. CONCLUSION

The fact that even thought our application GINS was published and are running, however the numbers of users are not large enough for the initial purpose. Therefore, we need to improve the system by make it available on IOS system too. There are huge of social problems in Viet Nam could be resolved by new technology that was combined from GIS, IOT, AI and Blockchain

## 5. REFERENCES

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