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An Analysis Of Patent Comprehensive Of Competitors On Electronic Map & Street View

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***Abstract*—A study of patent strength and patent comprehensive of competitors based on patent maps are presented in this paper. A worldwide prosperous technology, electronic map and street view, was selected to demonstrate the analysis. The occupied nodes percentage on a technology-function matrix, and occupied bones percentage on a fishbone diagram are easily calculated indexes of patent comprehensive.**

Patent pools in this study are from official database by USPTO. Patent strength and patent comprehensive of top three competitors, Google, Apple and Microsoft based on patent maps are analyzed, the result shows that Google takes the lead in patent numbers, and also owns the most comprehensive patent both in functions and technical developing road maps.

Keywords— patent analysis; electronic map; street view; technology function matrix;

I. INTRODUCTION

Electronic map has become a part of daily life since web mapping service developed by Google, who entered this field late but combined satellite imagery and map very successful. More recently, Google maps offer more powerful functions, street maps, 360^0 panoramic views of streets, real-time traffic conditions, and route planning for traveling by foot, car, bicycle, or public transportation. Google's street view itself is an objective of research [1][2][3], it brings new business models and legal issues, for example, private privacy. People rely it and except more functions.

Other companies joined the competition, Apple's map service was launched in 2012 with iOS 6 to replace the Google Maps application on iOS devices, Bing Maps is offered by Microsoft's mapping service with road maps and aerial/satellite imagery.

In order to become the winner in a highly competition of electronic map and street view, a company needs to do research and get a lot of patents. Patent is powerful to stop competitors enter claimed scopes based on its exclusive rights, and guarantee the achievements of R&D can get higher income from market. A company owns a big amount of patents is normal in modern industry. Famous companies like International Business Machines Corporation (IBM) and Microsoft Corporation (Microsoft), each owns more than 100 thousands patents. To accumulate sufficient number of patents and occupy a higher rank of main patentees in special technical field is important to get a large market share.

An analysis of competitors' patents on electronic map and street view based on patent map will be presented in this paper.

Patent analysis for special technical topics can evaluate patent and find the occupied technology, it is helpful and necessary before R&D [4]. Macroscopic of analysis including patent bibliometrics, patent citation analysis, to determine strength and value of a patent based on patent numbers [5]. Patent maps are useful tools to visualize the distribution of patents, monitor the trend of technological changes, infer the strategy of patent portfolios, and compare competitors by statistical charts or diagrams.

Macroscopic point of view may misconstrue patent value because lack of case review. The value of intangible assets should not be estimated only on its numbers. On the contrary, microscopic point of view can construct technical value for each patent but need labors and time. Both points of view are applied in this paper, the objective patent pool is analyzed by technology-function matrix and fishbone diagram.

A company can determine what patents have to be bought to enhance weak technical branches by patent map resolution [7]. A technology-function matrix can visualize sub-functions and sub-technologies of a product or service. How to get a matrix quickly is a research topic [6]. A fishbone diagram can visualize technical development or road map. Both maps are utilized in this paper, and patent comprehensive, an indicator of patent strength, of competitors is introduced at the same time.

II. METHODOLOGY AND MACROSCOPIC VIEW

The objective patent pool of electronic map and street view are gotten from official database of the United States Patent and Trademark Office. Search query is as following (search date: January 27,2016):

"street level" or "street view" in description, AND

"image" & "map" in description, AND

"340 or 345 or 701 or 707 or 715" in USPC, AND

"G06F or G06Q or G06T" in IPC.

Where USPC is United States Patent Classification, IPC is International Patent Classification.

We got 1,202 publication documents and 697 issue documents. Fig.1 is patent publication numbers, which equivalent to application numbers, of main applicants based on year. The first application appeared in 2005, and the total application numbers deeply increase in 2009. The top three applicants are Google, Apple, and Microsoft. Others filed less than 100 in total, includes CertusView, Nokia, PatentVC, ReinCloud, Here, IBM, Navteq B.V., etc.

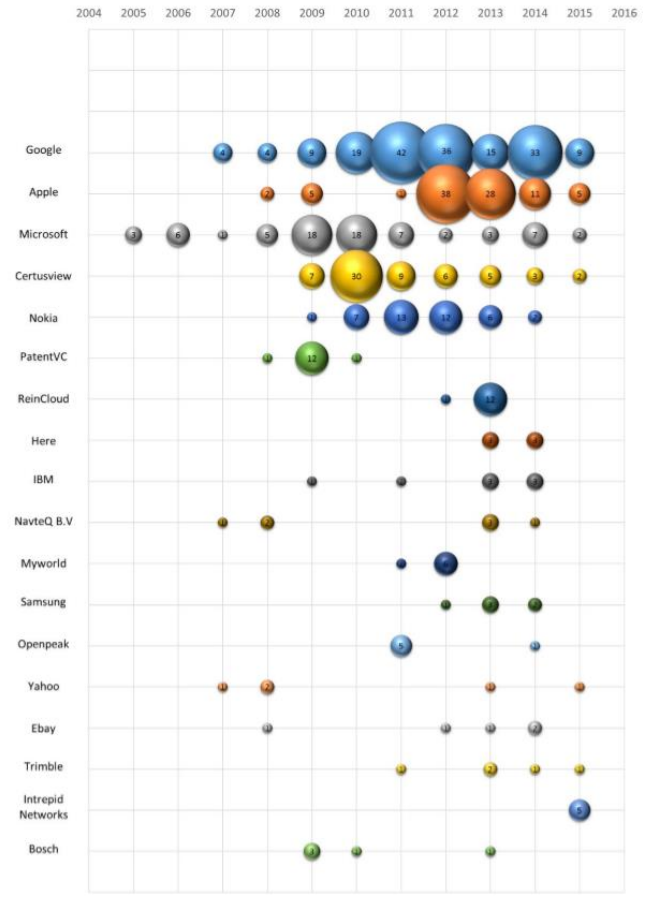

Fig.1 patent publication numbers of main applicants

Microsoft entered this technology field in 2005, earlier than other companies, and increased to the most in 2009 and 2010, but decreased in the following years. Google started in 2007, filed a big amount of patents in 2010, and occupies top 1 in total. Apple stared at 2008, lagged behind Google and Microsoft, filed only one application in 2011, but increased to 38 in the next year.

Fig.2 is patent granted numbers of main patentees based on issue years. Google occupies top 1 and gets a long lead to other patentees in total. Google utilizes the exceptions of publication under 35 U.S.C. 122(2) as main filing strategy, so gets patent issued without publication.

There are 2 or 3 years lag between application and issue, we can see that a big amount of issues began at 2012, and we can except that more issues in 2016 and the following years..

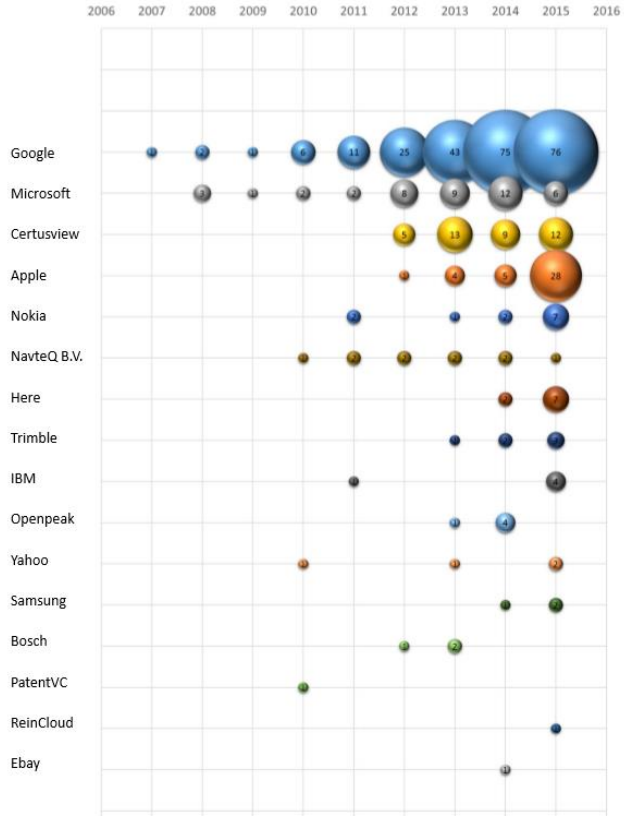

Fig.2 patent granted numbers of main patentees

III. TECHNOLOGY ANALYSIS

A. Patent classification of main applicants

After reviewed all objective patent documents, we divided them into three classes, device, image processing, and data processing.

Electronic map or street view may connect to mobile phones, vehicles or computers. Device is hardware, and further divided into subclasses of positioning navigation device and display device.

Image processing is very important in street view, and further divided into five sub-technologies. Recognition analysis is automotive photo processing to identify number plate, shop signs, traffic signs, and so on. Viewpoint selection offers users change viewpoint to get a good street view. Calibration can get an accurate position between street photo and satellite imagery. Panorama image transfers 2D images into

3D images. Graphical user interface is for users to select the image.

Data processing mostly is algorithm to do digital data processing, and further classified into data retrieval and annotation and data integration processing.

Fig.3 is patent applications of Google for each class. We can see that the numbers of applications increased at 2009.

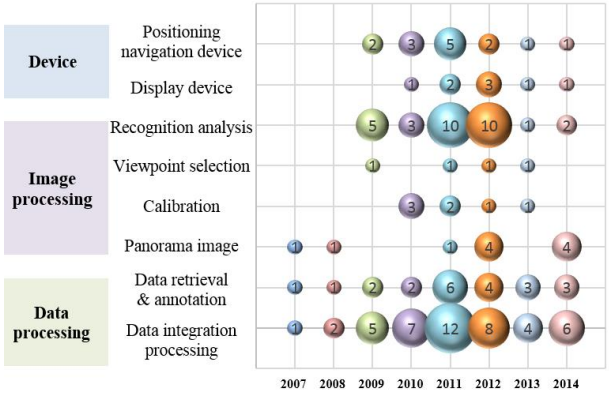

Fig.3 patent applications of Google for each class

Fig.4 is patent applications of Apple. It shows that big amount filing since 2012, same with Apple's map service. Apple has more applications in positioning navigation device than Google, but lag behind in data processing and image processing.

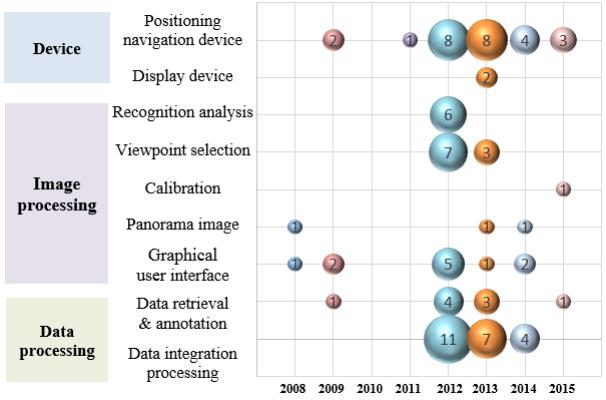

Fig.4 patent applications of Apple for each class

Fig.5 is patent applications of Microsoft. Microsoft entered this technology field since 2005, earlier than Google, but only in data processing.

Google has patents in all branches of technical fields, therefore, owns more comprehensive patent in electronic map and street view. Apple bases on device and extends to image processing and data processing, which is weaker than Google, especially in calibration and panorama image. Microsoft bases on data processing and extends to other branches, still needs more applications to catch on Apple and Google.

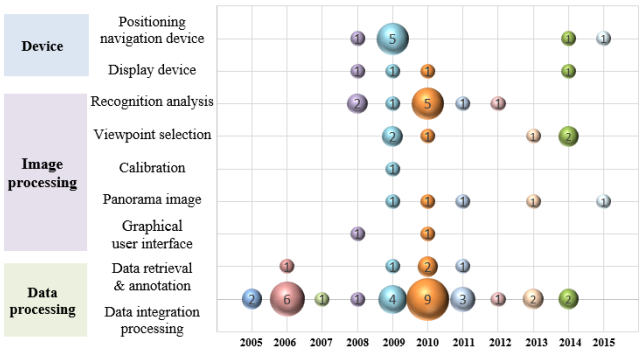

Fig.5 patent applications of Microsoft for each class

B. Resolution of patents by technology function matrixes

A technology-function matrix for a designated technology is a two dimensional matrix, which using the functions and the technical means to be its two coordinate axes, and drawing each nodes proportional to the number of patents. A bigger node means higher patent density which is a popular and crowded technical problem and solution. On the contrary, a smaller node means lower patent density which is a neglected or not yet solved problem and solution.

A technology-function matrix resolves a company's patents into means and functions, and shows its patent strength and comprehensive.

Three major functions in electronic map and street view, image optimization, efficacy, and application. Image optimization includes definition and improving quality. Efficacy includes access efficiency and computational efficiency. Application includes real-time road information, path planning, interactive map, commercial activity, and street view.

Fig.6 is a technology function matrix of Google. Google is strong in data integration processing, and has reached all functions, especially in real-time road information, path planning, interactive map, and commercial activity.

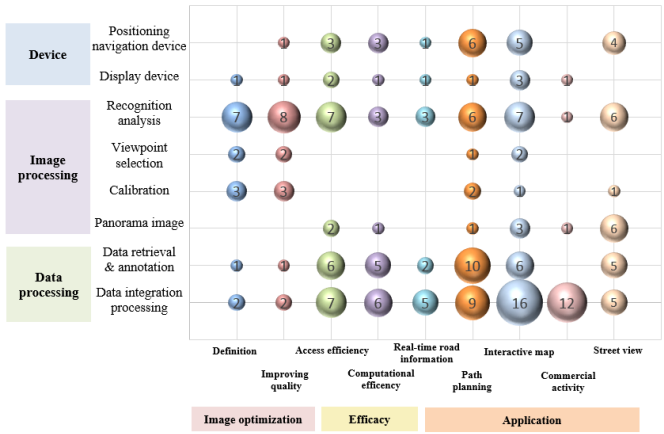

Fig.6 A technology function matrix of Google

Fig.7 is a technology function matrix of Apple and Microsoft. Apple has reached functions in image optimization and efficacy, however, only three functions in application, path planning, interactive map, and almost empty in functions of commercial activity and street view.

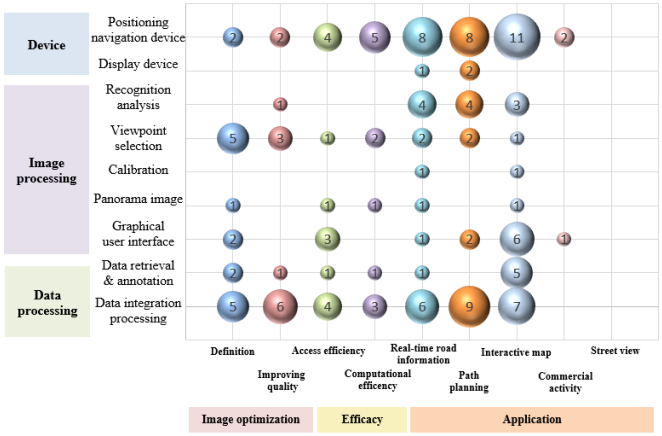

Fig.7 A technology function matrix of Apple

Fig.8 is a technology function matrix of Microsoft. It shows that Microsoft has finished all functions in data integration processing, but also has many nodes empty.

Technology-function matrix could be used to show the patent comprehensive or strength of a company. If we regard the occupancy in the matrix as an indicator of patent comprehensive, we can get that the indicator of Google is 0.78, Apple is 0.65, and Microsoft is 0.61. Google has the most comprehensive patent on electronic map and street view.

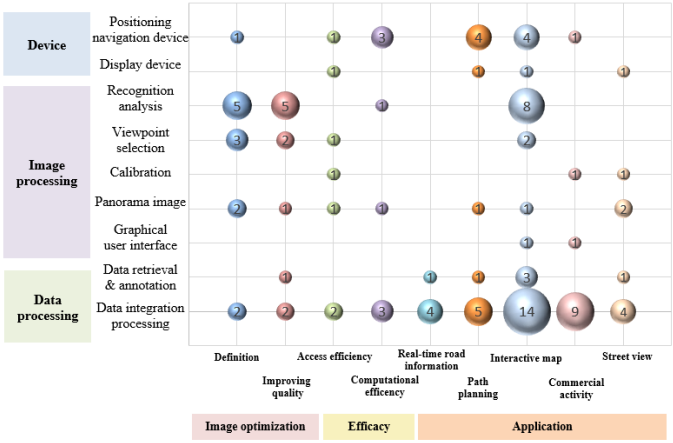

Fig.8 A technology function matrix Microsoft

IV. FURTHER ANALYSIS ON IMAGE PROCESSING

Image processing was selected to make further resolution. Fig.9 is a fishbone diagram of image processing of Google, Apple and Microsoft. Five branches of image processing are the main bones in the figure. Each branch is further resolved based on technical development. For example, recognition analysis is developed from Map tiles, and then 3D map models, 2D to 3D conversion, image enhancement, objects recognition, texture recognition, volume rendering, dynamic background, multi touch, and optical character recognition.

If we regard the occupancy in the fishbone diagram, we can get patent comprehensive or strength in image processing, the indicator of Google is 0.62(occupies 21 in 34), Apple is 0.5, and Microsoft is 0.44. Google takes the lead again in image processing.

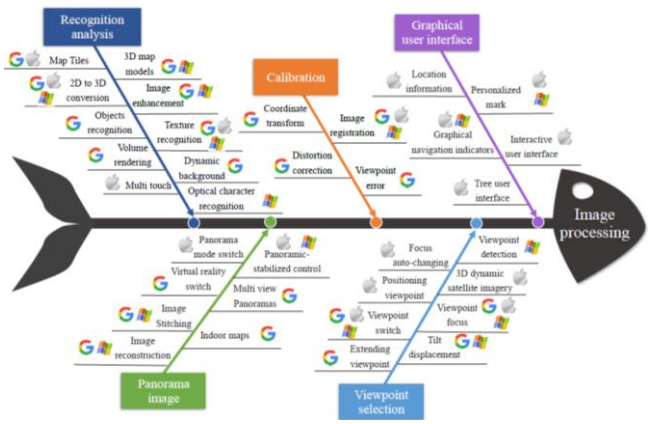

Fig.9 A fishbone diagram of image processing

V. CONCLUSIONS

Patent maps are useful tools for patent analysis, the technology-function matrix and fishbone diagram can visualize technical completeness and vacancies of top three applicants. Competitors can look for cooperation or buy patents to fill vacancy in the matrix and diagram. We can also easily get the indicator of

patent strength and comprehensive based on patent maps at the same time.

The results of analysis show that Google is the top 1 applicant and patentee in electronic map and street view in the U.S. in patent numbers, and Google has the most comprehensive patents in all branches of technologies and functions. Google can offer powerful web service if all patents are brought into force on internet.

The fishbone diagram shows technical development of five branches in image processing. Google is strong in recognition analysis, calibration, and panorama image, however, Apple is strong in graphical user interface and viewpoint selection.

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