Analysis of the Matching between Customer Needs and Patent Application Portfolio about Unmanned Aerial

Yosuke Towata, Yoshitoshi Tanaka
Graduate School of Innovation Management, Tokyo Institute of Technology, Japan

***Abstract*--In recent years, UAV called "Drone" has been getting popular, and more opportunities to be reported. Also it becomes easily available for the consumers, and the deployment of various industrial applications are expected. On the other hand, the legal regulation is requested to be more strict to avoid accidents and problems occurred by technical aspects. Companies can acquire the patent rights by the results of development. However, they are often conducted by techniques aspects without considering customers' needs. In some cases, patent portfolio does not meet meets the customer needs. Exclusive rights with weak customer needs do not contribute to increase the market share, the portfolio matching with customers' needs are essentially expected by the company. Therefore, we analyzed for matching between the patent portfolio and customer needs of the UAV manufacturing companies. So, we focus on the regulation and its practical data to grasp the customers' needs, analyzed for matching between the patent portfolio and customer needs of the UAV manufacturing companies.**

I. INTRODUCTION

Multirotor type UAV (unmanned aircraft vehicle) called "drone" has been attracting attention. In 2013, Amazon has announced a package delivery service, "Prime Air" using the UAV. If the video is published, in all the world, expectations for the industrial use of the UAV has increased at a stretch. Similarly, the transport company leading DHL in Germany, started the delivery project called "DHL parcelcopter" from 2013. In September 2015, the first time InterDrone, it is an international conference of the UAV, held in Las Vegas, lecture by CEO Chris Anderson of 3D Robotics has been made. Chris Anderson said drones are now becoming "smartphones with propellers" instead of "airplanes without pilots." In CES2010 was held in Las Vegas, Parrot has announced a multi-Copter type UAV "AR.drone" that can be operated in communication from the iPhone. Anyone can enjoy the easy Aerial shooting and intuitive flight operation.

It is, as a package product of commercial multirotor type UAV, was the first time in the world.AR. Drone was awarded the 2010 CES Innovation Award, and Parrot has become a pioneer of commercial UAV.

II. DEFINITION OF MULTIROTOR TYPE COMMERCIAL

A. Classification of UAV

As described above, if there is common that not human ride, different types of aircraft are included in the concept of the UAV. They can be further classified form of wings is flying principle used during take-off, type and method of supplying power, or self-supporting flight possible or human operated, the size of the aircraft, by the function of such. And, these functions are considered to be selected depending on the application.

B. The difference of the fixed-wing aircraft and rotorcraft

Fixed-wing aircraft is generally having two of the same structure such as an airline passenger plane, it is necessary to horizontally sliding in order to obtain the necessary lift for takeoff. It can't be a vertical take-off and fixed-point waiting, is in the movement in the horizontal direction, the efficiency in terms of speed and fuel use good. Exceptionally, in the military, there is a VTOL machine such as known as "Osprey", is it possible to horizontal flight by the vertical take-off and the main wing by the rotating blades. On the other hand in a rotary wing aircraft doesn't require a runway, can be vertical take-off, it can be fixed point waiting by hovering. Instead, the movement in the horizontal direction efficiency is poor, flight speed cannot be increased as fixed-wing aircraft.

C. Features of the single-rotor type

Single rotor type motor is located in the structure has been recognized as a so-called helicopter conventionally. And basically, it can fly by a single propeller (rotor). But, reversal torque is generated by the rotation of the main rotor is in the air. Therefore, general helicopter is provided with a tail rotor to offset this. In addition, there is also such a tandem rotor type and coaxial type, is of variable pitch, which will be described below, are those similar to the single-rotor type. Single rotor-type characteristic is that which changes the pitch of the propeller during rotation. Variable pitch is a technique has also been utilized, such as a propeller and ships screw of fixed-wing aircraft, and determines the movement direction in the air by changing the machine control pitch. Single-rotor machine of variable pitch to do so, take a fairly complex mechanism and its control, such as a swash plate. Helicopter of the conventional single-rotor type is the same.

1.Technical characteristics of UAV

Multirotor type characteristics, when compared to single-rotor type, and that the number of rotors is plural, is that the propeller pitch is fixed. The number of rotor have a even number to offset basically 4,6,8 ... and reversing torque, movement in the front and rear left and right is controlled by varying the rotational speed of each rotor individually.

Therefore, necessary to change the propeller pitch without complex mechanical control and mechanism is not required. So to speak, in a multi-Copter type, may be said to machine control other than the rotation speed of the propeller is nil.

This point is the greatest feature of the multirotor type UAV called recently drone. As a result, by replacing the mechanical design problems programming problem, stability is greatly improved, moreover it becomes possible to realize it with low cost. For the rotational speed of the propeller, on the basis of the instructions and information of the sensor from the operation equipment, flight controller to control. Therefore, what is important for the stability flight control is the type and the performance of the sensor and program for flight control. If general consumers want to build up a multi-Copter type UAV, it would be sufficient to purchase a commercial flight controller to suit the required frame and motor, the propeller. The flight controller, an acceleration sensor with miniaturization, a gyro sensor, a magnetic sensor, such as pressure sensors are already included. The reason for such a low-cost flight controller has been realized, miniaturization and high performance of the mobile phone is in the background. Recent smart phones are equipped with various sensors, such high performance in miniaturized sensor is came to be provided to UAV companies.

2. Definition of Commercial Use UAV

From the above, a multi-Copter type commercial UAV to be the subject of investigation in this research,

I. People can't ride from its structure
II. Intended to be sold as a consumer not for military
III. Having a plurality of rotary wing does not have a fixed wing
IV. Multirotor type of fixed pitch rather than a single-rotor type of variable pitch

The subject of the above conditions are met unmanned aerial vehicle.

III. RELATIONS BETWEEN R&D AND CUSTOMERS' NEEDS

A. R&D Information extracted from Patent Information

The results of research and development by companies through the patent application activity, appears as a patent is an exclusive right. Especially in the new industrial area, sometimes devastating damage to the sales of Pioneer by imitation products. Therefore, in general, companies do patent application activities in order to protect the features a technology of its own. A result of a patent application activities of the company, can be investigated by the patent information. Patent information, has a legal status and technical information, in this study mainly to use the technical information. In this research, to extract or commercial UAV manufacturers from patent information is doing what technology development. Then, the extracted for R & D information and product features of the UAV companies.

B. Customers' Need on Commercial Use UAV

Customer needs can be distinguish to five types of needs: (1) stated needs, (2) real needs, (3) unstated needs, (4) delight needs, and (5) secret needs. Thus, the needs includes those not actually declared, if there is no still product the needs would that there is no means to satisfy it while there is a need state. Thus, "needs" includes a desire not expressly. Even as a customer had a need, if it does not exist there product to be satisfied, we can't even meet the needs. In order to create a new market by innovative product, we have to understand the strong customer needs unmet by conventional product. Multirotor type UAV is a product that has not been sold in the consumer market in the past. As reason why the UAV has spread to consumers, it is presumed that there may be elements that meet any needs. In Japan, 2015 December 10 and later, the flight of the UAV more than 200g must obtain the permission of the Ministry of Land, Infrastructure and Transport (MLIT). We have thought that from the proceedings of the permit application for the MLIT, can discover the purpose of the flight. It should also be able to extract the needs of consumers for the purpose of flight.

IV. PURPOSE OF THIS RESEARCH

After revision of the Aviation Law, multirotor type UAV is important to know what kind of industrial applications in the future. In this research, by analyzing the patent information of the leading companies, to discover the region in which the company is developing technologies to concentrate. In addition, we examine the application for approval to the MLIT, know the needs of any consumer has appeared as any flight purpose. Finally, by comparing the consumer needs and corporate technology, to analyze whether or not they are well adapted. Through the above research, and it aims to contribute to the industrial applications development in the future of the UAV.

Big 3 Companies for Commercial Use of UAV

(1) Parrot

Parrot is a French company, which was founded in 1994 by Henri Seydoux. It sells mainly to automotive communications equipment and audio equipment. In 2010, the company launched the AR.Drone. This UAV was able to maneuver the aircraft from smartphone via Wi-Fi. AR.Drone 2.0 was launched in 2012, and Bebop Drone was launched in 2015. And, fixed-wing type UAV "Disco" was presented at the CES2016. In addition, it has been released "Minidrone" an ultra-small multirotor type UAV, and vehicle model "Jumping Sumo" which jump and run by two wheels remoted.

(2) DJI (Shenzhen Da-Jiang Innovations)

DJI is a Chinese company, which was founded by the "Frank" Wang Tao. Wang Tao had studied the helicopter stabilization technology while attending the Hong Kong University of Science and Technology. DJI launched Phantom Series which is Quad Copter type UAV for general consumer. Now, DJI became the company with the largest

global market share in sales. Phantom is the most sold UAVs in the world, in addition to this, capable of high-quality shooting "Inspire 1" is also being sold.

(3) 3DR (3D Robotics)

CEO of 3DR is a Chris Anderson, who is known as a former editor-in-chief of WIRED. First, he had been a managing amateur UAV community called DIY Drones, after, established a company for the UAV business. In 2014, IRIS + which is UAV designed for hobby purpose has launched. IRIS + equipped with a camera by GoPro. In addition, not only the aircraft, the company has published a flight control application "Droid planner" series, which was developed in open source. It is a system that allows automatic maneuver the UAV. 2015, SOLO has started selling in the United States. This aircraft, the general consumer only and not as an object, intended for aerial photography market of professional skill in the art, the camera is equipped with a still made of GoPro. In addition, 3DR has not filed a patent application. Therefore, patent information of 3DR in this study are not included in the analysis data.

V. RESULTS OF PATENT INFORMATION ANALYSIS

A. Patent applications by Parrot

1. Number of patent application at the first country

The number of the first application in France of Parrot shown in Figure 1. Parrot have started a patent application related to UAV since 2006. Most often the number of applications in 2010, which announced the AR.Drone at CES. Since then, it has been the application of the order of several cases a year. Application amount of 2015 is unpublished yet.

The number of patent applications in is small, but Parrot is very active for foreign patent applications with priority right. The number of family patent applications in other countries is described in Table 1. There are recorded a country where Parrot has been filed in other than France.

Although the number of the first application is 32, there are a family application 134. There are 4 foreign applications per 1 first application. Parrot can be said to be quite aggressive against foreign application. Of course, but also it includes international patent application (WO), the number is not many. Country located high in the number of applications are Japan, Europe, the United States, and China. These are rather than a large country of the market, it is simply the country there is a major patent office.

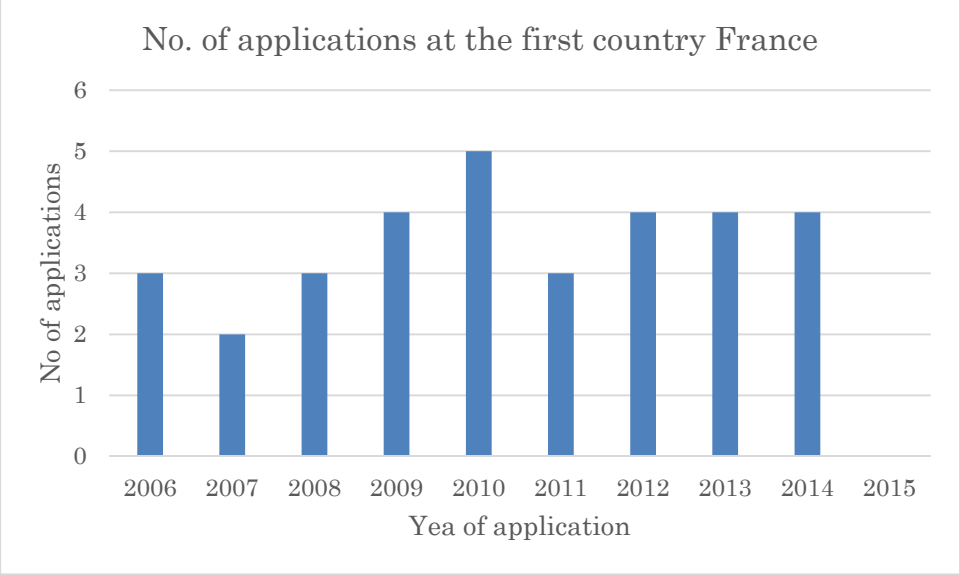

Figure. 1. Parrot/ No. of patent applications at the first country France

TABLE.1 NO. OF FOREIGN PATENT APPLICATIONS BY PARROT

Filed country	number
Austria (AT)	2
China (CN)	22
Germany (DE)	12
European Patent Application (EP)	28
Hong Kong (HK)	3
Japan (JP)	26
United States of America (US)	27
International patent application (WO)	12
Foreign application ratio	91%

2. Analysis on technical characteristics from patent classifications

The IPC and CPC granted to the applicant of Parrot, shown in Table 2 that listed from most to least common number. Usually, if we want to guess the quality of the technology by using the patent information, evaluate the presence or absence of registration, citations, temporal variation of the IPC, but this time not using those methods. First, the patent application family to this analysis, the time the applicant has been started is relatively new, time-varying element is scarce. Second, examination has not been completed, not determined evaluation as patents. So, this time to grasp the importance of the technology by the distribution of IPC. Table 2 below shows the number granted IPC in Parrott application.

This result can be seen that many of which are considered "model aircraft" in the application of Parrot. Invention belonging to A63H is intended to be essentially classified in model airplanes. Further, A63H 30/04, G08C 17/02 is a technology about maneuvering the aircraft by using a radio wave. G05Q 1/08 is related to control in order to stabilize the posture. What can be said from these distributions, except premise that helicopter conventionally is one that controls the aircraft by a radio, a characteristic portion in the application of Parrot are for stabilizing the posture which belongs to G05Q 1/08 it is considered to be a technology related to the control. Also, it is shown in Table 3 for the CPC.

Distribution of the CPC, a large difference is not have followed the basic IPC of distribution, clearly classification B64C 2201/108 that it is UAV has been newly extracted. Others include, A63F 2300/69, such as A63F 2300/8017, that classification has been granted on the “video game” has been extracted. Application for these games, on the screen of the tablet terminal to be used as a maneuvering unit, were things like make a shooting game in the UAV each other reflects the image of the reality of the aircraft. These are the initial application. This is because, in the technology when the "AR.Drone" has appeared in the CES2010, an AR (Augmented Reality) technology itself.

3. Important inventions based on the number of patent family

Upon identifying the important invention for the Parrot, using an evaluation by foreign family number of documents. Since The largest percentage in the patent application cost is the translation fee. Therefore the application that filed in many foreign countries, it comes to invention that companies are multiplied by the expectations. Table 4 shows the first application filed in many foreign countries and corresponding application number, patent number, and overview of the invention. In this table, there are patent applications about function for maneuvering the aircraft by tilting the tablet, displaying an image, and controlling the posture of aircraft by the image analysis. These function is a feature of the UAV of the Parrot. The specification of the patent application for steering by tablets, an important issue is described as the ability to maneuver the aircraft intuitively by the operator. Further, in the patent application for stable vertical takeoff by image analysis, an important issue has been to allow for vertical takeoff especially difficult for novices. This is to allow easy to maneuver by inexperienced persons, in particular, considering the case of operating indoors by children. While there is also such a information processing technology, housing in order to protect the sensor unit, such as easily replaceable propellers and motors, it is also focuses on mechanical design technology. Overall can be said about the application of the Parrot is that priority of UAV function was focused on delightful experience of consumer pilot by intuitional maneuvering. Also been registered many patents in France, it is understood that the company has a high technology.

TABLE. 2 IPC GIVEN TO PATENT APPLICATIONS OF PARROT

IPC	number	Overview of technology
A63H 27/133	17	Helicopter as a toy airplane
A63H 30/04	16	Handling of toys by the wireless communication
G05Q 1/08	10	posture control
A63H 27/127	7	Toy airplanes that are enabled vertical take-off
G08C 17/02	7	Maneuvering by wave communication
B64C 39/02	6	Aircraft that features a special purpose
A63H 27/24	3	Toy airplane with battery as power

TABLE. 3 CPC GIVEN TO PATENT APPLICATIONS OF PARROT

CPC	number	Overview of technology
A63H 27/12	36	Classification of the toy airplane
A63H 30/04	21	Handling of toys by the wireless communication
B64C 39/024	13	Aircraft to steer by radio wave
B64C 2201/108	9	UAV using a rotating blade
B64C 2201/027	8	UAV flight frame (Flying tops)
A63F2300/69	7	Those that bring the elements of the real world to the virtual world of the game
G08C17/02	7	Maneuvering by wave communication
A63F2300/8017	7	Which is characterized by the kind of game (flight, onshore and underwater)

TABLE. 4 PARROT'S FRANCE PATENT APPLICATIONS AS TOP OF PATENT FAMILY NUMBER

Overview	Appl. No.	Patent No.	family
Due to the inclination detection of the tablet Operation of the aircraft	200806665		8
Virtual shooting game	200806800	2939325	7
Operation of the aircraft by the tablet	201051751	2957265	7
Fuselage of the housing	200958011	2952787	6
Consolidated structure of exchange easy motor and propeller	200958013	2952549	6
Vertical take-off control by the vertical image analysis	201054945	2961601	6

B. Patent applications by DJI

1. Number of patent application at the first country

The number of the first application in China of DJI shown in Figure 2. DJI have started application since 2009. And, the number of patent applications has become the largest in 2014, that year is the after when the Phantom series have released. Patent application 2015 has been published earlier than usual time. Perhaps, put out a request for the public to aggressive against SIPO, they are trying to eliminate the third-party application. The number of family patent applications in other countries is described in Table 5.

Table 5 shows that DJI mainly filed patent application in Europe and United States. The number of patent applications to Japan is small, but because for the most part, which is an international patent application, there is a possibility to increase in the future.

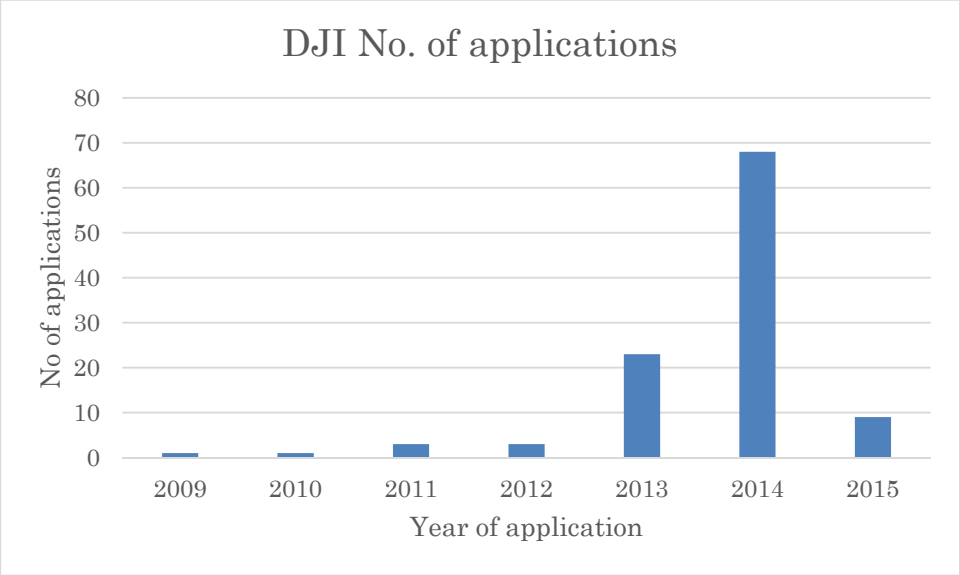

Figure. 2 DJI/ No. of patent applications at the first country China

TABLE. 5 NO. OF FOREIGN PATENT APPLICATIONS BY DJI

Filed country	Number
Austria (AT)	2
Canada (CA)	2
Germany (DE)	1
European Patent Application (EP)	10
India (IN)	1
Japan (JP)	5
Korea (KR)	2
Mexico (MX)	2
Russia (RU)	2
Taiwan (TW)	3
United States of America (US)	19
International patent application (WO)	35
Foreign application ratio	35%

2. Analysis on technical characteristics from patent classifications

About IPC and CPC that has been given to the application of the DJI, show those located in the upper level for the grant number in Table 6 below.

Looking at this result, it can be seen that there are many invention relates to the holding of the camera in the application of DJI. F16M 11 / * to belong invention relates to application on the gimbal are all camera of the holder. In addition, also the section B64D 47/08, G03B 17/56 is a different, but the invention of the camera around. What can be said from these distributions, is that characteristic portion in application of DJI is said to be an invention relating to the holding of the camera. Further, it is shown in Table 7 for the CPC.

DJI is granted number of CPC is small because fewer foreign application, it can be seen that in many cases invention relates holder of the camera as in the IPC.

3. Important inventions based on the no of patent family

Table 8 shows the application number of family literature highest number in the DJI, the outline of the invention of the check the description of the specification. For in using the composite priority DJI is doing a complex foreign application, not life-support that one application one invention.

Application Family Reference number higher are both relate the structure of the three-axis camera gimbals for holding the camera, it is for stable Aerial movie shooting. The operation of the gimbal is to be done based on the sensor information from the inertial module has filed a housing of the inertial module relates to an electric control method of operating a gimbal in motor.

Furthermore, there are applications for the communication method for operating in cooperation leaving the single UAV and the photographer and the operator. This is one the one hand the imaging is a technique for concentrate on steering.

Then, raising the droop has been supporting leg at the time of landing after take-off, it was also filed on the mechanism for widening the field of view of the camera

Thus, true for the entire application of DJI from these results is that has been developed a technique for implementing the UAV specializing in aerial.

TABLE. 6 IPC GIVEN TO PATENT APPLICATIONS OF DJI

IPC	number	Overview of technology
F16M 11/18	11	Support means for relatively moving the article
F16M 11/06	9	Supporting means of the rotatable article
G05D 1/10	9	Control of the course in the three-dimensional
B64D 47/08	6	Placement of the camera
G03B 17/56	6	The camera of the holder
B64C 27/32	4	Aircraft using a rotating blade
F16M 11/12	4	Two or more axes of rotation retainer
F16M 11/16	4	Holder has the effect of fixed

TABLE 7 CPC GIVEN TO PATENT APPLICATIONS OF DJI

CPC	number	Overview of technology
B64C 39/024	7	Aircraft to steer by radio
B64D 47/08	7	Placement of the camera
B64C2201/027	6	UAV flight frame (Flying tops)
B64C2201/127	6	UAV to be used in the Aerial
B64C2201/108	5	UAV using a rotating blade
A63H 27/02	4	Model airplane
F16M 11/06	4	Supporting means of the rotatable article
F16M 11/18	4	Support means for relatively moving the article

TABLE 8 DJI'S CHINA PATENT APPLICATIONS AS TOP OF PATEN FAMILY NUMBER

Overview	Appl. No.	family
3-axis camera gimbal structure	201110380344	26
	201110380351	
	201410182852	
3-axis camera gimbal structure	201310109643	10
	201310109693	
	201310109706	
	201310109707	
	201310432300	
Housing of the inertial module	201080068428	7
3-axis gimbal electric control method	201310330321	6
Radio-controlled by two of the steering machine	201310468739	5
	201480002508	
Deformation mechanism of the support leg	201310008317	5
	201380048477	

VI. ANALYSIS FROM THE APPROVED APPLICATION FORM

For permission and approval in accordance with the flight of the unmanned aircraft, at the Ministry of Land, Infrastructure and Transport of the site, part of what has been the permission and approval has been posted. At the time of the January 16, 2015, application of 5 1112 were received, 469 have been authorized and approved. Have been published as of which 231 Reviews has been granted and approved .What is published, the applicant, the applicant terms on the Aviation Law, flight date and time of flight location, name of the aircraft, of the permit approval number, in the authorized date of approval. Applicants from these information, application terms, the analysis for the name of the body do. A permit or approved application terms shown in Figure 3. First of all, the flight of the "Densely Inhabited Districts (DIDs)" in the application of the provisions of Article 132 (flight location) was the 178 of the most 231 Reviews. This is due to the fact that most cities portion corresponds to the population concentration area.

Since the purpose of the application is in the Ministry of Land, Infrastructure and Transport for personal information was that not the public, based on the above results, perform a search on the Internet separately from the name of the received applicant's permission and approval, the individual with to identify the applicant, except, it was examined for the purpose of the flight. The day the search was conducted is a 7 to 15 January 2016. For the purposes of items of the flight, in light of the standard purpose of the flight, and a description of the table for the specific example of the "examination procedure of authorization and approval on the flight of the unmanned aircraft," according to the Ministry of Land, Infrastructure and Transport, has been identified on the basis of clearly stated business content to the applicant's home page of the business content such as page of, to extract those that conform to the purpose of each flight. The results are shown in Figure 4 below.

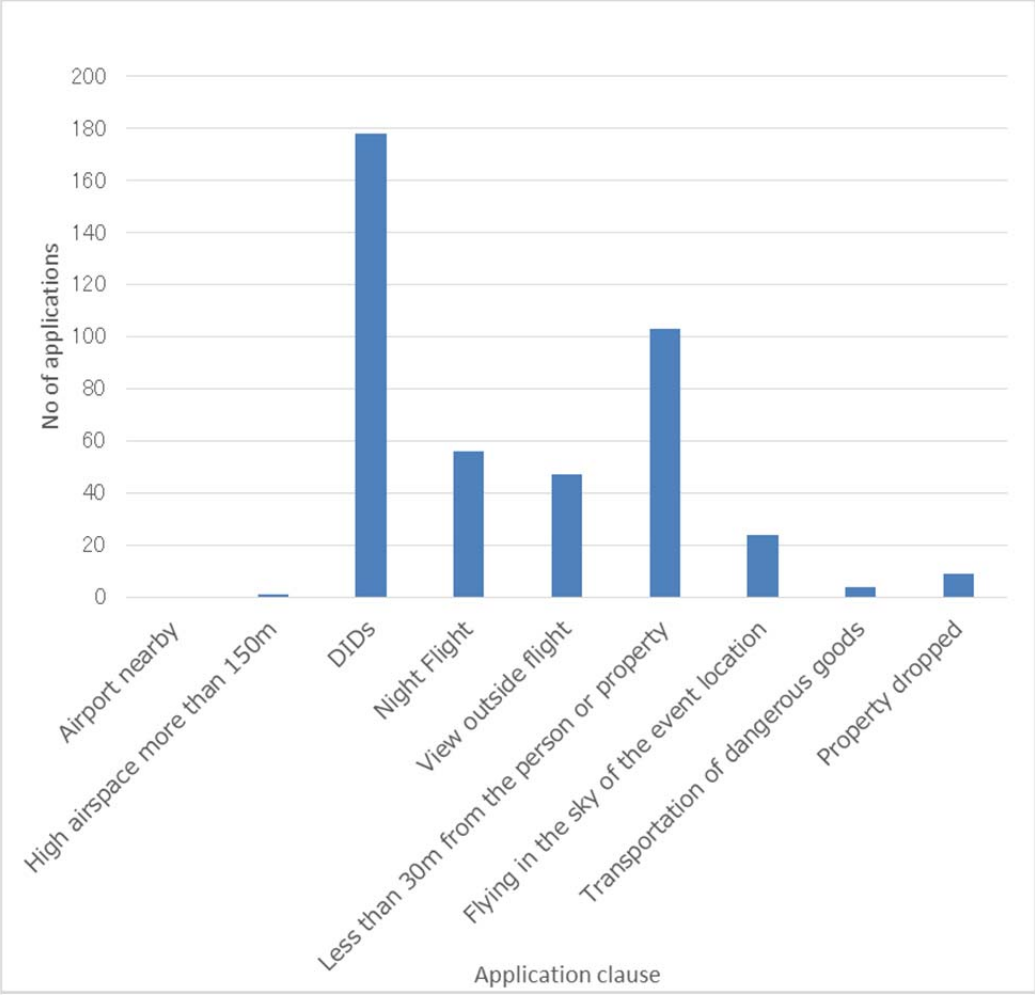

Figure 3 Number of applications of each application clause

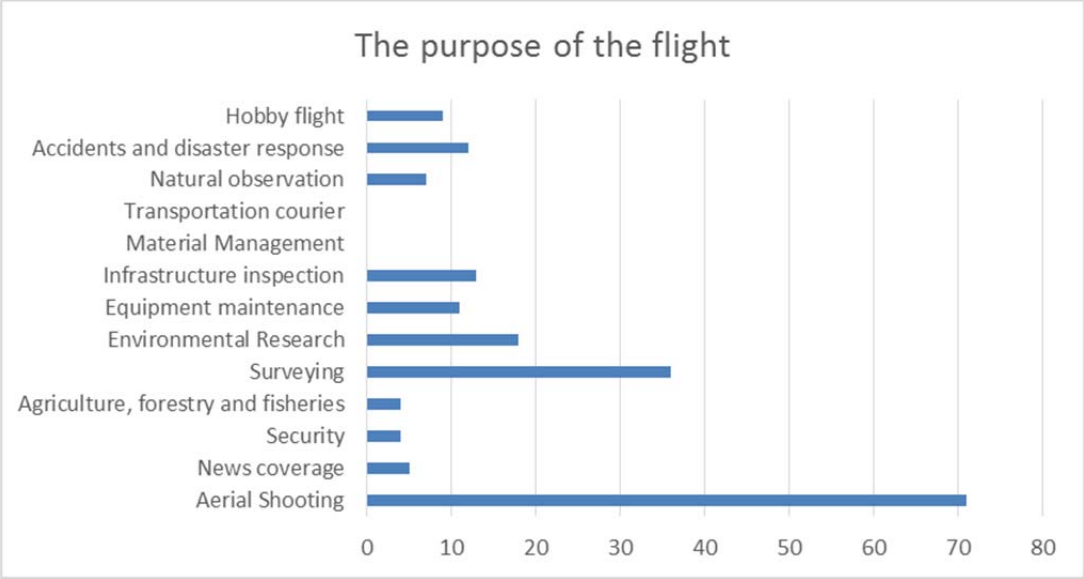

Figure.4 the purpose of the flight of the UAV

In the results of the investigation, the applicant for the purpose of "Aerial" was the most common. The "Aerial Shooting", as described in the table above, shooting of landscape and facilities, TV · filmmaking, in which an event such as photographing. That is, to obtain a video or photo performs taken from a camera attached to the UAV. Then often it was is given to the applicant for the purpose of "surveying". The "survey", there is a survey or the like in the construction site. For this, there is no direct surveying function to UAV itself, on the basis of the image data obtained, the vertical downward aerial ortho-mosaic processing and to planar map of bonded photographic images, from multiple angles by integrating photographic images from the angle it is conceivable to perform 3D modeling of terrain. Therefore, it is considered to be the purpose of the indirect measurement based on the data acquired using a UAV.

For the "Environmental Research", "equipment maintenance", "infrastructure inspection and maintenance" is, the applicant to be carried out as a business to any there were many. The purpose of "environmental research" is, the status of the contamination of soil and river bank, in which the UAV to shoot. For the "equipment maintenance", "infrastructure inspection and maintenance" is, dirt and check of solar panels, bridges, state of the structure of the tunnel and the like, such as the situation of deterioration of the building, high altitude and the human can't be easily observed, inspection about what is the area of the place are many time-consuming, examples can be cited, such as to check the situation She sees the sky by UAV.

In the "accidents and disaster response", the number is small, but and on-site verification of traffic accident, company to perform the appraisal, include the example used, such as in an accident investigation insurance company.

Examples such as "transportation courier" and "asset management" could not be found. For the drop of transport and property of hazardous materials, at the moment, as described above are recorded in the line item of "agriculture, forestry and fisheries" in the single rotor-type unmanned helicopter it has been limited to approval, their purpose. The "Material Management", which appears to be assumed materials management or the like in the outdoors, the majority of the material is considered to be managed indoors. Since the well flight indoors is not a subject to regulation, because there is no need to obtain permission and approval by the application even in such as in a warehouse doing autonomous flight for check stock, and those not apply at the moment Conceivable. From the above results, since the constant tendency for the applicant on the basis of the flight object of was observed, Figure 5 shows a summary for each business category. The most common is, video production skill in the art to which corresponds to the purpose of the above aerial shooting, an aerial shooting skilled in the art. Are these vendors are doing a service to provide a video doing the aerial shooting, is doing a service to produce a video and program by processing the sky transfer video. Thing that was then a lot is, construction industry, a construction consultancy. These vendors have done a survey and environmental survey to accompany it for construction. In addition, it has also carried out inspections and maintenance, etc. of the building. Also, in order to visually grasp the progress of the construction work is like are using the Aerial. For the other, research and development companies, and at the university seems to be flying for the test. In addition, and that can't be identified applicant's site in part on the Internet, there was a thing is unknown specific can be purpose and application.

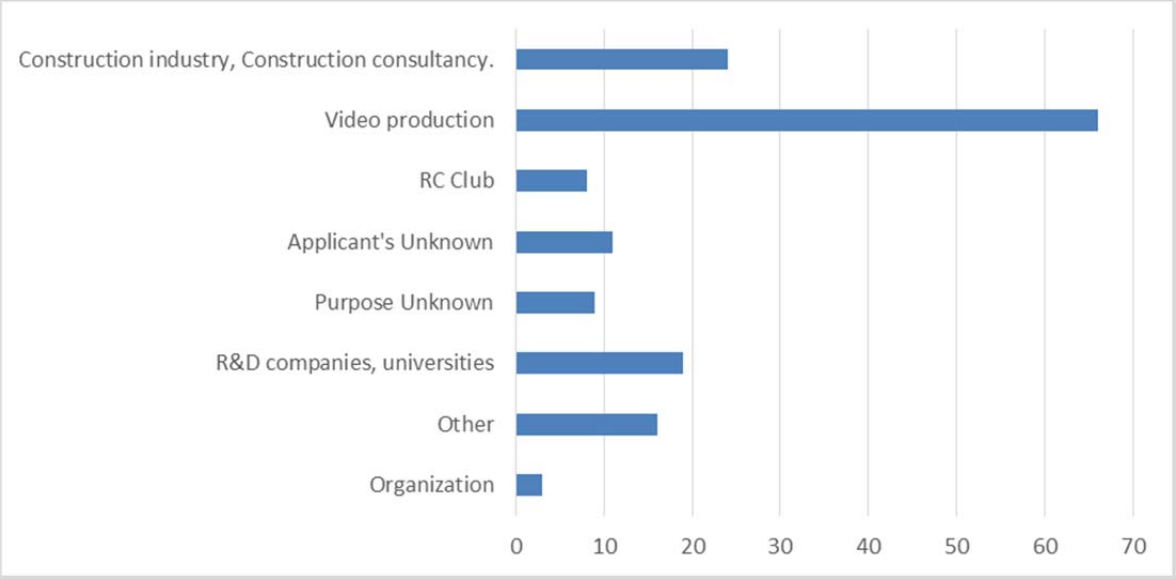

Figure .5 the applicant's business category

From the above results, the majority of those who have received the permission and approval of the flight of the unmanned aircraft, it was found that the aerial skill in the art, and are construction related art. And more easily put together, most of the persons using the fuselage of the DJI, considered Aerial suppliers and individuals perform aerial, construction relationship skilled in the actual situation is that have a grasp of the surveying and construction situation It is.

VII. COMPARISON MATCHING OF PATENT INFORMATION AND THE APPROVAL APPLICATION CONTENTS

Compliance with patent application network and the required functions to the UAV

Here, technology related to the method of the special flight pertaining to the permission and approval of unmanned aircraft, and for the patent application relating to it to consider. Than the examination procedure "according to the authorization and approval of unmanned aircraft by the Ministry of Land, Infrastructure and Transport, necessary in the case to take a special flight method according to the 2 each issue of 132 Article, meet the additional criteria in accordance with the flight form. There is a need. Item This additional criteria, first, matters relating to the performance and function of aircraft, second, matters related to maneuvering ability to be imposed on the operator, and third, there are matters concerning the system to ensure the safety, imposed as a function of aircraft from this It was extracted for. The basic performance of the speed of the aircraft is largely dependent on the performance of the parts such as motors and sensors with respect to functionality imposed additionally in accordance with a special flight forms, regardless of the existing technology, patents this is because the application was believed to express a novel technique performed.

(1) Flight in the flight-entertainment over in less than 30 meters from the densely populated district, people or property

A) Having a structure to reduce the harm upon contact listing for aircraft

i) reception of GPS or the like is no longer function, has its function of holding the position in the air until the return, it can acquire the position information other than by function or GPS, etc. to allow safe automatic landing capability thing.

iii) Unforeseen circumstances has occurred, it has a function is not that the aircraft immediately fall.

D) Having the function of limiting the airspace to try to fly

(2) Night flight

E) That the attitude and direction has a lamp so that you can accurately visibility for aircraft

(3) Visual inspection outside the flight

Equipped with an autopilot system, it can be monitored state outside the machine body by a camera or the like which is installed in the fuselage.

(4) Hazardous materials transportation

That g) equipment that is suitable for the transport of dangerous goods are provided.

(5) Goods dropping

viii) Aircraft, it is not a mechanism for carelessly dropped the goods.

For application on the invention which corresponds to additional criteria it was further extracted from the first country patent application of DJI and Parrot extracted above. The results are shown in Table 9.

TABLE. 9 APPLICATION NUMBER THAT CORRESPONDS TO THE ADDITIONAL CRITERIA

Function	Parrot	DJI
Impact mitigation	1	0
Incommunicable fail-safe	2	1
Falling speed reduction	0	3
Flight area limit	0	1
Lamplight	0	0
Automatic pilot	1	1
Hazardous materials transportation	0	0
Goods dropping	0	0
Total	4	6

The number of patent applications is also corresponding to the additional criteria in any of the companies was small. In particular, e) night flight at the time of lighting, g) equipment that is suitable for the transport of dangerous goods, h) for the structure that does not inadvertently dropped the property did not have the application. Although provided as functions for lighting believed was not a certain features as to the patent art. In the two items related to transportation of property, as the UAV of DJI is believed that not a performance that can withstand the function of transporting the property at this stage. The structure to reduce an impact, there was filed on propeller guard for the purpose of this in Parrot, the DJI did not. The technique of holding the position of the air at the time of b) GPS or the like can't be received, there has been filed in any of the companies. For example, in DJI it was that to determine the position with reference to the history of the acquired GPS information to it. For information about features that c) the aircraft is immediately so as not to the time of fall, there is application only to DJI, which activates the parachute and, other propeller so that the speed of the fall in the case where one of the propeller is no longer function to recommendations such as those that control, goodness of fit to the item there was a high application. The ability to limit the airspace to try to d) flight, in DJI, by referring to the information on the no-fly zone based on the GPS information, there has been filed related to the control not to perform the flight to the airspace . F) For autopilot, it has been filed in the control method for performing automatic navigation by specifying coordinates in any of the companies. From the above results, there are applications that overall DJI corresponds to the additional criteria, to infer that there is an advantageous situation in the examination of the application.

VIII. CONSIDERATION

A. compliance with the purpose and patent application of flight

In this research, we extracted the characteristics of the leading manufacturing companies of multirotor type commercial UAV, Parrot, and DJI, by analyzing the patent information. According to this, Parrot has been found to be performed and posture control in the air of the aircraft, a technical development with an emphasis on intuitive maneuver of the aircraft. On the other hand DJI was found to have carried out a technical development that specializes in "Aerial" to shoot the video in the air. In addition, Land, from the results of the contents of the publication of about the flight of unmanned aircraft that has been authorized and approved by the Transport Ministry, the majority of aerial companies that have done as a service, Aerial data construction industry relationships that make the core business skilled in the art, by individuals found to be a flight of hobby, most of which was the application by aircraft of DJI. From these results, is related to the moment the sky is what is being used as a business in the flight of the UAV in Japan in the shooting, said that aircraft share by DJI that specializes in high-quality aerial photography has been almost exclusively it can be said that is also a situation is not an exaggeration. Although the factors that aircraft of the DJI is employed a variety of factors such as price and awareness is likely to be related, functions related to Aerial is also believed to be the cause, from the patent application content for technology related to its function confirmed. Therefore, this until the product can't be satisfied, the multirotor type commercial UAV is estimated that the needs could be newly satisfied was that it is possible to perform high quality aerial.

B. compliance with patent application and the required function to unmanned aircraft

For the application corresponding to the additional criteria for unmanned aircraft in the examination procedure of the Ministry of Land, Infrastructure and Transport, Parrot, DJI but both sufficient number of applications did not, is fit for the overall contents of the additional criteria of the application by the DJI considered to be high. This is speculated that not became contributes to aircraft DJI is employed. Transportation or even hazardous materials in any of the company, there is no application adapted for dropping the property, a situation which is not to be realized as a product. This feature currently is believed to have a single rotor-type unmanned helicopter.

IX. FUNCTION REQUIRED FOR THE FUTURE OF UAV

Based on the results of the investigation of this research, we discuss what is required to multirotor type commercial

UAV future. First, as a technique about the capabilities of the aircraft, to have the ability to comply with additional criteria of unmanned aircraft, may be required from now on that application as compared to the aircraft, such as the existing DJI is facilitated is there. For example, the number in the results of the above study was small, the structure and such as harm to property and people by contact at the time of the aircraft falling is reduced, the aircraft in the night flight posture, such as lights, which can be easily determined it is a function. In addition, when considered from the aspect of the purpose of the flight, from the time of the results, the purpose of the flight, but he that is Aerial, what you want the original customer to order the shooting in aerial skill in the art is an air of the video, construction is a topographical data in the work relationship of skill in the art. Sky For video shooting skill in the art to shoot, but there is one aspect of creative activity by humans, such as movies and shows, there is no room to be included in such a creative element for geographical data, more mechanical automatic control it is considered to be required. Thus, the purpose is also believed that gradually differentiated as a means of satisfying this being enclosed in a common section of Aerial currently. Therefore, motivation to adopt a fuselage that is versatile for each purpose is considered to gradually fade. In addition, in the other purposes, which is uses for transportation, etc. of small goods of permits and approvals at the moment. It has been recognized that have been developed by Amazon and the like, are those expected realized.

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