Analysis of Urban Environmental Pollution
Using Remote Sensing

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1. Introduction

Urban environmental pollution is a real and important problem today. Our task is to benefit the mankind and to creat pretty, comfortable living environment for descendants. First of all, the problem about emvironmental pollution be studied and treated seriously, specially in city, because it's not only influencing environmental landscape, regional planning, but also influencing ecological balance and body health directly.

In order to control contamination effectively the current situation of environmental pollution must be known, which is a basic and fundamentel work. In the past, field inspection and visitation the spot were used to investigate the case of environmental pollution. According to this procedure, we need to do enormous work and the real position of pollution could not be entirely owned since conditional confideme. Now, remote sensing technology provides us with effective and possible means. After a lot of experiment and exploration, it's very obvious that remote sensing image have some advantages, such as looking explicit, complete, accurate and contenting lot of information. Using remote sensing technology can not only reduce the work in field, but also raise accuracy of our result and speed up investigation. It has been provided that using remote sensing technology to survey the condition of environmental pollution in city is a scientific and good method.
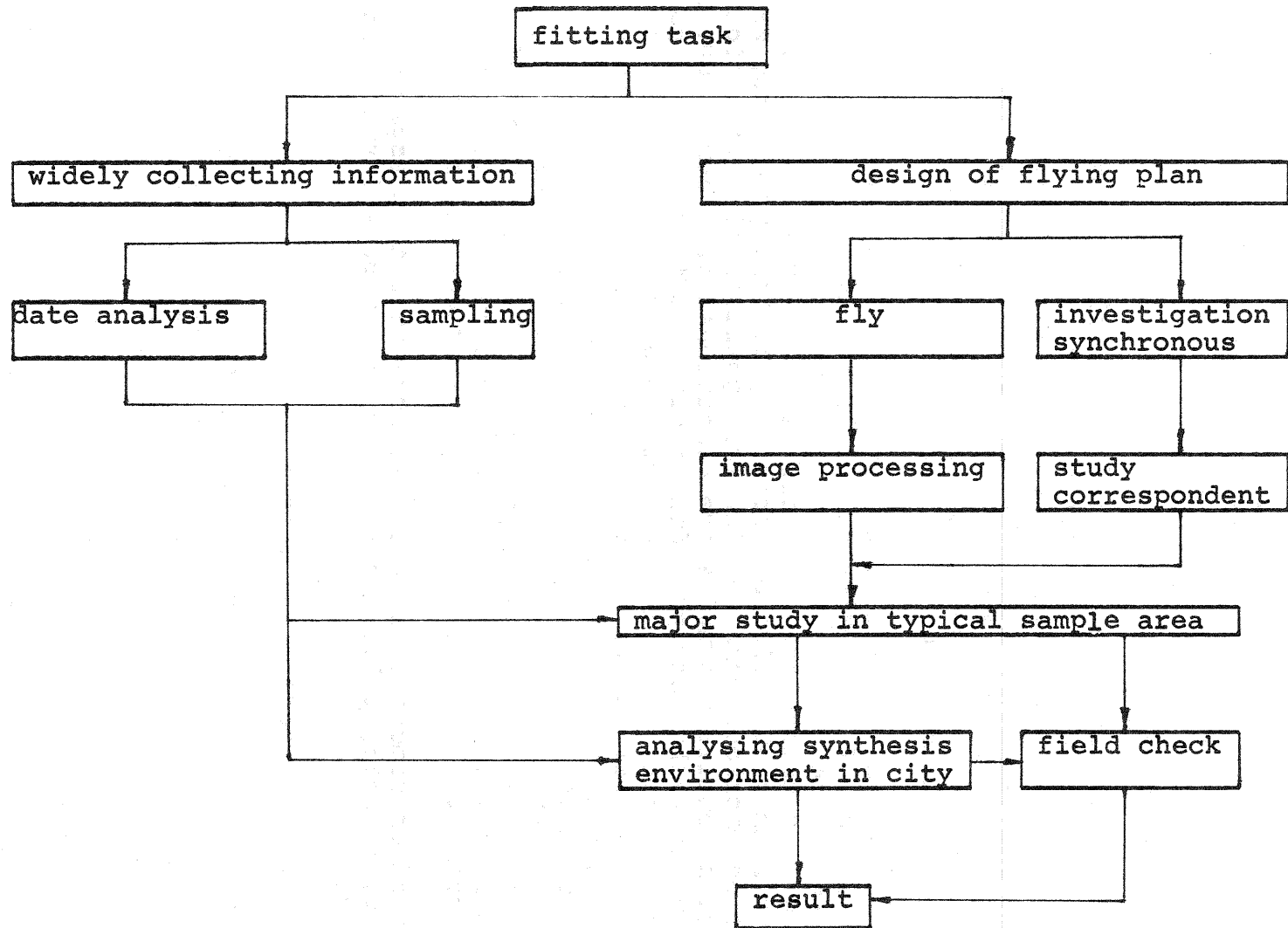
Based on remote sensing image, some important aspects of urban environmental pollution have been analysed and studied in this paper.

2. Study procedure and method

Every method of modern remote sensing technology has its own charcter. We think, after trying repeatedly, it is a good method to use color infrared aerial remote sensing observing the question of environmental pollution.

Mostly, in process, using color infrared aerial photograph, we have directly taken image analysis by visual interpretation and we have surveyed some laws coming from remote sensing information and characters of image. On the other hand,according to requirement of task, the flying plan of aerial remote sensing would be designed and operated reasonably. During flying period, a representative and typical area would be chosen to match with field inspection and sample analysis. On the other hand, various basic information would be widely collected and analysed together and utilized sufficiently.

Mean skeleton of working program on using remote sensing image to
survey urban environmental pollution

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3. Principle and character

We have gotten some experiental conclusions when colour infrared aviation remote sensing images are used to investigate environmental pollution of cities. as following:

A. Colour infrared remote sensing is based on that the ground has different reflecting and absorbing properties and produces different principles of image reflect, the colour image which records the rich information of object reflecting green, red when infrared has been gained with taking a photograph, using color film which is painted with three sensive layers, sensing green, red and infrared,the interference of the blue-purle light in visible light is cut off by using yellow filter. On this kind of the image,the objects of reflecting green light is recorded as blue bright; the objects of reflecting red light is recorded as green light; the objects of reflecting infrared is recorded as red light. For example, three elements colour including blue, green and red constitutes plentiful colours of different degree through different combination, which is very useful for eye interpretation and special analysis. On this image, the various factors reflect the environment of cities response sensitively, the image feature is very obvious.

B. Colour infrared aviation renote sensing images gather various advantage of general aerial photography,colour photography, and infrared photography, while it provid plenty information.

   The geometric character of the image which is photographed is center throwing shadow. Image can be observed.intepreted, measured, and mapped stereoscopically with solid image couple gained by overlapping photograph.

   In practical use, we adopt the way of combination of one image interpreting with multi-image interpreting. The better result has been got by synthetical analysis for the character of image feature, size, shadow, trace, and relative position.

4. Utilizing analysis

Now, the main pollution of urban environmental pollution comes from sources; voice, water, gas and sediment. To take one step ahead, a series of contaminations will be occurred such as for vegetation, soil and biosphere etc.

Then, to aim directly at above mentioned, we have analysed points of emphasis to pollution factors using color infrared aviation airphotoes, the results are successful and satisfactory.

A. Water pollution

It has been proved that the best application effects was produced in water, because water is sensitive band if infrared ray. The tone of water in color infrared image is very obvious.

Various water quality becomes blue tone in color infrared image, the depth of tone variation ralating to the depth of water, commonly, deep water appear dark blue tone, shallow water appear light blue, tone variation of water in image is much more influenced by whether the water is fresh or chaotic. Generally clear water appear dark tone. chaotic water appear light and polluted water or the water contains dust appear grey-blue tone on images.

According to that mentioned-above, the characters of information in infrared airphoto can be used to analyse the status of water at the moment of taking photo, then to seek pollution source, to delimit pollution zone and region, to distinguish pollution degree, to assing direction of excreting contaminate. Besides, in color infraredairphoto we can analyse and judge influence stage of pollution on soil which caused by polluted water based on moisture content.The same, this way adapts for monitoring the growing condition of aquatic plant which float at the surface of water.

B. Air pollution

On urban environmental pollution,usually air pollution includes all of the poisonous gas, smoking, dust etc.

Ordinarily,if there is pollution excreting into air or excretion that haven't diffused at the very moment of photoing,the air pollution status would be shown obviously in color infrared aviation image.For example, the degree of exhausting amoking of all chimneies(including in industry and family), smoking and dust coming from factory etc., would be reflected in image.

Additionally,on the strength of image feature and tone signature,we can clearly identify smoking and dust that appear as white misty mass. On airphoto it is obviously different from coloud's. Based on information from image, we can resolve position and classification of air pollution, seek air pollutant, analyse excreting type of smoking and dust. We may evaluate air pollution degree.To move further ahead, after taking contrast analysis to neighborhood photoes and neighborhood photographic stripphotoes, we even can infer scattering codition and law of air, smoking and dust.

The problem about poisonous gas having influence on environment around, we would analyse and judge according to the case of plant growth beside maximun pollution area.

As we known, red represents reflectance characteristic of landmark.The stronger the reflectence, the darker the red tone.

Reflectance of plant chlorophyll is very high in refrared ray band. The law is, that the highre value of chloroghyll, the higher the reflectance. The wax protecting film on plant leaf reflectance is higher, thus in color infrared image the plane showe red tone, whether the tone is dark or light based on the leaf condition, content of chloroghyll and health position in growing and so on, between spongy cell structure and cell wall in leaf, the reflection occurs repeatedly, because of strong reflection, this kind of leaf shows dark red in image. Contrarily, the withered and po-lluted leaf, the chlorghyll content of a leaf reduces relatively and moisture content of a leaf reduces too. Cell structure of a leaf have been harmed to be sunken and collapsed, the strength of flection is very small, on image is light red tone. Meanwhile, based on degree of har-ming, the tone varies from brown tone to green. Then we can judge the influential condition of pollution.

C. Solid waste

Incity a lot of excreting waste is an important problem to environment. Both poisonous industral scrap-heap or ordinery waste material and lots of rubbishes coming from all days life. All of them are influential factors to urban environmental pollution.

In color infrared photo, by image features, we can conclude exactly exhausting case of various solid wasters,rubbishes, trases etc., and can also understand the storage place. Thus, the best excreting way would be studied.

By observating and measuring stereoscropic pair, super-ficially, we may estimate content of solid waste in pile place. After using comparatine analysis to image informa-tion in various period, it is visible for us to find vari-ation law of excreting waste and piling up, to decide in-fluential degree and extent. The method and data above-mentioned is very foundimantal, valuable. In the past, the methods and means of investigation had to waste a lot of time, take a lot of exertion and difficult to study accurately. So it proves that using remote sensing has its advantages.

5. Results and suggestions

A. It has the prospect cheerful for using aviation remote sensing in invertigating urban environmental pollution. Having proved, the effect is very obvious. To represent remot sensing technology advanced and superior, some people think, however, remote sensing technology is only satellite's, not including aerospace remote sensing. The others think that aerospace remote sensing is primaty and is the preparatory stage of satallite's. However in my opinion, these ideas are not absolute by right, because the volue of using remote sensing has not been really under-stood.

I think, aerospace remote sensing and satellite photo are

all the constituent parts of remote sensing technoloty, aerospace remote sensing are based on air photography, expanding informational band, increasing image manner. It can enlarge the photography of B/W image to color, infrared, multi-spectral and various image of scan radar. And it can develope recording type from film to tape.Thus, we can make sure that, air photography is a kind of airspace remote sensing. Emphatically, airspace remote sensing and satellite image are parts of remote sensing, the difference between them only height of remote sensing platporm. The differece of using aspsite must collect relately to applicating remote sensing. On studing urban environmental pollution, using airspace remote sensing is right and achieved good result.

B. There are results on studying urban environmental pollution, as follow:

The table represents that it's difference for various study object to observation results. According to requirment, we should select appropriate types of image to focus on judgement.

The table also shows, that color infrared image is the best tool for surveying urban environmental pollution, of cause, if there are various manners of remote sensing to analyse relatively. the resultes will be better.

C.a. The aerospace remote sensing records are the ground truth at the moment to photo. It's limited and accidental, so that we must study various factors completely and synthetic, and connect with other data relatively.

b. Fixed amount for environmental pollution, other ways are required. Especially, air pollution, the estimate of its concentration etc., is impossible to receive from image.

c. Using remote sensing image to investigate environmental pollution must connect with major sampling, chemical analysis is field. By analysis of data in typical sampling area, results well be achieved correctly. For instance, on estimating water pollution, we need sample and check, need connect with remote sensing image completely to analyse and study.

d. By visual interpretation for color infrared remote sensing image, the ione of image are shown obviously and visually. But now, because there is no united standared for tone of image to control. There are differences in tone for various periods to reproduce. We have analysed and studied tone's marks relatively now, not scientifically complete because of without united model.

D. Tendency for development

In studying and analysing the problems of environmental pollution of cities with using remote sensing images, now we only analyse the remote sensing information of environment pollution presently, which is used to investigating and

appraising. I think that the problems of   environment
pollution in city is in many ways, the remote   sensing
technology may be researched further.For instance,   remote
sensing images are appled in researching administraction of
city environment pollution, in researching environmental,the
schemes of harnessing environment can be posed, the secien-
tific management and automatic appraisement of   city
environment may be realized by coordinating remote sensing
automatic observation.

Remote sensing technology brings into practice   many
aspect we should take remote sensing   technology   as   a
advance technical mean which are studied   deeply   and
spread energetically.

Application results of studing urban environmental pollution:

	water pollution	air pollution	solid waste	vegatation	soil
B/W photo	C	B	C	C	C
color photo	B	B	B	B	B
B/W infrared photo	C	B	C	B	C
color infrared photo	A	B	A	A	A
thermal infrared photo	A	B	A	B	C
multi-spectral band photo	A	A	B	B	B
Annotations	Illustrate: Where A.B.C.represnt effects. A: excellent B: good C: pass (common)				