STEREOSCOPIC IMAGES
THROUGH WMS SERVICES

CEN/TC 287 AWARD for Excellence and Innovation in INSPIRE2013

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0. ABSTRACT

Some years ago, the engineers belonging to Sigrid S.L. had a new idea about the cartography which could be served through the Internet using the Web Map Service (WMS) standard from the Open Geospatial Consortium (OGC™). In this way, in addition to the usually 2D raster and vector maps that were already served by almost all the existing map servers, the observation of data from photogrammetric flights might be very useful for a broad sector of cartography users.

The ability of serving through the Internet all the capacities of the photogrammetric flights could allow the application to become a powerful tool for photo interpretation and other cartographic tasks as restitution, made easier by stereoscopy and metric rigour of photogrammetry, respectively. Other advantages of use this map server are the low cost of publishing photograms and the possibility of put it into operation only a few days after the photogrammetric flight. Once this map server was fully developed, other abilities, as the generation of stereoscopic images using the synthetic stereoscopic technique, were added.

In order to achieve this aims, the developers of Sigrid S.L. had to design a new server called StereoWebServer. The WMS services derived from it, due to its whole range of utilities, were rapidly recognized by several Spanish Spatial Data Infrastructures (SDI) which were in developing process in the framework of the INSPIRE Directive. Some of these Spanish SDIs who implement WMS services derived from StereoWebServer are the following:

- Infraestructura de Datos Espaciales de España (IDEE) - Spanish SDI: http://www.idee.es/en/
- Infraestructura de Datos Espaciales de Referencia de la Región de Murcia (IDERM) - Murcia SDI: https://cartomur.imida.es/

In accordance to this Directive, the Spanish SDIs must to include network view services which are defined by the Implementing Rules (Article 11(1) of the Directive); meanwhile the Technical Guidance View Service, which describes detailed aspects for implementing these view services, was also developed.

Due to this, the assumption of the WMS standard from the OGC™ is an irrefutable fact and converts this standard in a key for the interoperability of INSPIRE network view services. In order to accomplish with this standard, Sigrid S.L. has developed StereoWebServer using all the ISO 19128 WMS parameters. However, with the aim of be able to supply 3D stereoscopic images and other value - added services through the Internet, have been necessary to introduce any changes primarily on the WMS styles and to create new parameters. Furthermore, new specialized WMS clients focused on to display real s3D images have been developing, while others WMS clients and Internet browsers are currently capable of show only anaglyph s3D images.
From Sigrid S.L., we think that these adaptations realized in order to increase the potentialities of WMS standard with stereoscopic capacities and other photogrammetric functionalities could be adapted at the 2 aim of the **CEN/TC 287 AWARD for Excellence and Innovation in INSPIRE 2013**.

### 1. ABOUT SIGRID S.L.

Sigrid S.L. ([http://www.sigrid.es/en/home.php](http://www.sigrid.es/en/home.php)) is a Spanish company characterized by its cutting-edge cartographic and informatic services, result of a long experience in taking advantage of technology to produce quality and usable cartography. Was founded as Limited Liability Corporation in 1995 and has its head office in Tres Cantos (Madrid) and its production facility in the Technology Park of Boecillo (Valladolid). The company has been recently registered in the [smeSpire webpage](http://www.smespire.eu/).

In order that our products are up-to-date and competitive, Sigrid S.L. promotes the continuous development of the R&D&i in the areas of data generation systems and cartographic visualization technologies, as much in the user’s computer as through the Internet. One of our most important projects is **StereoWebMap** ([http://www.stereowebmap.com/en/index.php](http://www.stereowebmap.com/en/index.php)), whose **StereoWebServer** is the aim of this report, being fully explained below.

### 2. STEREOWEBMAP

Some images belonging to this document required to be observed wearing anaglyph glasses to perceive the s3D effect. These images are indicated using the symbol: 

![3D symbol](image)

#### 2.1. INTRODUCTION

**StereoWebMap**, taken as a whole, is a catalogue of products and services based in 2D and 3D online maps which includes:

- **StereoWebServer**: is the principal technologic innovation, which is the basis for the rest of products and subject of this report. Developed in C++ language and designed for run in Win32 and Win64 O.S., it is an internet map server able of sent the cartographic data hosted in a server, in the form of a 2D or s3D image, through WMS services. It meets the OGC™ standard (versions 1.1.x and 1.3.0). The completion of this application has been made possible by the support of various agencies and institutions that once bet on that development.
The more remarkable capabilities of StereoWebServer are:

- Management of an unlimited amount of source data, both raster and vector supplied in their original format, without requiring specific conversions for this server.
- Special preparation for Coordinate Reference Systems (CRS) used in Spain which can be used whenever the data in its original CRS, and serving in any other CRS with error not greater than one pixel at any point of the image.
- StereoWebServer is able to manage all the information derived from a photogrammetric flight, both photographs and orientations. The server provides the users with all the capabilities of photogrammetric flights, stereoscopic views and accuracy included.
- It is also possible to generate 3D views using synthetic stereoscopic (2D image + Digital Terrain Model).
- Multiple styles of visualization:
  - 2D as orthophotography on the fly.
  - s3D in anaglyph mode.
  - s3D in stereo real mode.

- **Web Map Services derived from StereoWebServer:** the list of the services currently operating is:

<table>
<thead>
<tr>
<th>WMS service</th>
<th>WMS’s URL</th>
</tr>
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<tbody>
<tr>
<td>StereoWebMap</td>
<td><a href="http://www.stereowebmap.com/SgdWms/SgdWms.dll/WMS">http://www.stereowebmap.com/SgdWms/SgdWms.dll/WMS</a>?</td>
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<tr>
<td>ItaCyl</td>
<td><a href="http://orto.wms.italy.it/Server/SgdWms.dll/WMS">http://orto.wms.italy.it/Server/SgdWms.dll/WMS</a>?</td>
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<td><a href="http://euskadi.sigrid.es/SgdWms/SgdWmsEuskadi.dll/WMS">http://euskadi.sigrid.es/SgdWms/SgdWmsEuskadi.dll/WMS</a>?</td>
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<table>
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</table>

Table n° 1: WMS services derived from StereoWebServer.

These WMS services have free access from any WMS client.

- **WMS clients**: Informatic developments which allow the user to make requests to WMS services, receiving and showing the results. They can be classified in:
  - Thin clients (geoportals).
  - Thick clients (SigridMap, StereoWebViewer and StereoWebEditor).
  - Applications for devices with Android O.S. (StereoWebMini).

- **Other services derived from StereoWebMap**: when the service is created, is possible to obtain other products as:
  - s3D images for posters and presentations.
  - s3D aerial videos.

## 2.2. HOW DOES STEREOWEBSERVER WORKS?

**StereoWebServer** works according to the Document / View architecture. This architecture is based on the idea that one part is the data (Document), and secondly how they are displayed this (View).

![Doc-View On The Web](Image)

Figure n° 2: Document / View architecture.
For a mapping applications, Document comes in files with formats such as *.dwg, *.shp, *.tiff, *.jp2, & *.ecw and the View that the map is assembled from these files.

### 2.2.1. Generating the View for One WMS Service

At first, all Document considered as necessary to compose the View has to be added in our SigridMap software.

![Image](image1.png)

Figure nº 3: preparing the View.

Then, is necessary to define how the data have to be displayed. For example, is possible to indicate that a document (topographical map at 1: 25.000 scale) is only visible in a certain range of scale, while if enters another scale range, is another document that is left visible (eg orthophotographies). Thus, each WMS service determines a concrete scale from which the stereoscopic mode is activated; for example, GeoEuskadi WMS service activates the stereoscopic mode only when the scale is bigger than 1: 30.000.

![Image](image2.png)

Figure nº 4: images from GeoEuskadi WMS service with different scales. On top: scale 1:50.000 (raster 2D), below: scale 1:4.000 (anaglyph stereoscopic mode).

It is also possible to configure the presentation styles. For example, you can also leave a certain outstanding data to be highlighted in a view (eg hydrography). Once the View is composed, the data are displayed on the form chosen as the zoom level or the selected style.
2.2.2. STEREOSCOPIC VIEWS

StereoWebServer is capable of serve all kinds of cartographic data through the Internet, as other map servers can. However, it is the unique map server capable of send stereoscopic images produced using data from photogrammetric flights and synthetic stereoscopic. These stereoscopic maps can be composed in the same way as Views described above.

Figure nº 5: schematic operation of StereoWebServer.

- Photogrammetric flights:
  - In this case, the View has to include the data corresponding to a photogrammetric flight (photograms, orientations and camera calibration).

Figure nº 6: data from photogrammetric flight.

- The photogrammetric flight should be normally viewed stereoscopically; for to achieve it, and taking as basis the stereoscopic principles, is necessary to send through the Internet a picture to be viewed with the right eye (obtained from one
photogram), and another to be viewed with the left eye (obtained from the other photogram).

- When requesting a zoom of an area, the application selects the pair of photograms closest to the zone of interest, creating a stereoscopic pair and extracting from each photogram the part of the image for that area.

![Figure 7: anaglyph image generated using the stereoscopic pair above the selected zone.](image)

- **Synthetic stereoscopic:**

  - The synthetic stereoscopic is the result of combine a Digital Terrain Model (DTM) and a 2D image (orthophotography, satellite image...), obtaining s3D images.
  
  - In order to achieve this aim, the algorithm calculates automatically the vertical position of the pixel of the image using the Z coordinate from the DTM, thus generating one view for each eye, under the stereoscopy principle, and then providing an s3D image.
  
  - The following steps are similar to the process described for photogrammetric flights.
  
  - In addition, when a WMS service has been developed using synthetic stereoscopic technique is possible to exaggerate its 3D depth by adding the parameter SYNTMAGNIFICATION=XXX to the WMS request, where XXX is a numeric value which usually ranging between 0.01 and 2, so as this value increases, the exaggeration rises:

    - With value = 0.01, the view will be displayed in 2D, as an orthophotography.
    - With value = 1, the stereoscopy will not have exaggeration.
    - For values between 1 and 2, the stereoscopic exaggeration will be observed.

Figure n° 8: Image created using the synthetic stereoscopic technique and SPOT5 2D image.

2.2.3. Associating the View with One WMS Service

Once the View has been configured in SigridMap, a *.sgv file is generated, which contains all the information pertaining to the View. Then, to register on the server, the view is associated with a WMS service name. After accessing the service, you can make requests to it via WMS.

2.2.4. Visualization Modes

Using the adequate parameters in the WMS request, it is possible to manage the visualization mode in which the image is served from a WMS service derived from StereoWebServer. It is also recommended to review the Annex II for obtain the fully information about the configuration of StereoWebServer.

2.2.4.1. Real Stereo (S3D)

It is a stereoscopic visualization mode which does not require the anaglyph technique and provides with stereo real mode visualization give greater s3D visualization quality with several advantages:

- It allows the user to observe images in true colour.
- It is less eye - tiring
- It decreases significantly the error in Z appreciation so the data collection using the stereo positioning technique is more efficient.
- It produces a more real sense of depth of relief.

In order to obtain images in real s3D, the WMS service has to send a double - wide image, in which the left part corresponds to what the eye sees the right and the right side, the corresponding image
to the left eye. This is a format commonly used for the generation of stereoscopic images (such as *.jpg format).


Figure n° 10: example of a double - wide image.

The WMS standard has no definition for the sending these double - wide images. Consequently, the normal WMS clients are not prepared to present the result of the corresponding GetMap request.

In addition, the hardware of the client from where the request is made has to be equipped with:

- Graphic card: it must be able to support stereo Open Graphics Library (OpenGL) standard specification; for example, NVIDIA Quadro® and ATI FireGL®.
- Monitor: it must be able to support a minimum of 100 Hz frame rate. In case of mobile devices, the screen must to have integrated real s3D.
- Visualization: only one of the following auxiliary devices is needed:
  - Active LCD shutter glasses (For example: NVIDIA Kit 3D Vision®).
  - Polarized filter and passive polarized 3D glasses.
  - Auto stereoscopic displays.
  - For presentations or exhibitions: OH projector equipped with any of the aforementioned systems.

As already mentioned, the WMS clients are not designed to receive double - wide images. So when they receive one image of this type, each interprets the information as it best can. Therefore, Sigrid S.L. has developed specialized WMS client software that is able to interpret these double images:

- StereoWebViewer, StereoWebEditor and SigridMap, for Windows O.S.
- StereoWebMini, for mobile devices with Android O.S.
These applications are all capable of display the images in real s3D if they detect that the hardware of the client which makes the request allows it. This detection is a process based in the OpenGL. When it occurs, the WMS client requests the double - wide image automatically.

In according to this, the only way to see images from StereoWebServer in real s3D mode is when the user fulfills two requirements at the same time: hardware sufficiently equipped and one of the aforementioned WMS clients installed. In other cases, as using other WMS client or an Internet browser, the server sent the images in the mode in which the WMS service is configured by default (e.g. anaglyph image or orthophotography on the fly). Sigrid S.L. is aware that this is a solution which doesn’t meet the WMS standard from OGC™, so it has been necessary to develop other solutions as shown in the next chapters.

2.2.4.2. ANAGLYPH (S3D)

This technique consists of overlapping two stereoscopic images whose colour has been previously modified by applying a red filter to one of them and a cyan (or green) filter to the other. If these images are observed using anaglyph glasses, a different image for each eye is obtained (red and cyan / green), so the user will perceive the depth effect.

As already mentioned, the parameters of WMS standard and the WMS clients are not designed to show double images. Due to these facts, it has therefore been necessary to improvise a solution for to solve these problems achieving to adapt the WMS standard: to make the image to be sent directly by the server in anaglyph mode.

In order to do this, it is necessary to indicate in the request that the image you wish to receive in anaglyph mode using parameter STYLES as following:

STYLES=SGD_StereoModel::ShowAnaglypticOn.

The following image is an example of viewing a photogrammetric flight showed as anaglyph image:

http://www.stereowebmap.com/SgdWms/SgdWms.dll/WMS?&VERSION=1.1.1&REQUEST=GetMap&LAYERS=EUSKADI2011&FORMAT=image/png&SRS=EPSG:25830&STYLES=SGD_ViewOptions::DrawGraphScaleOff|SGD_ViewOptions::VectorInvisibleOff|SGD_ViewOptions::RasterInvisibleOff|SGD_StereoModel::AdjustToFlyDirectionOn||SGD_StereoModel::ShowAnaglypticOn|SGD_StereoModel::OrthoOnTheFlyOFF&BBOX=574318.7341671076,4775510.5013844447350000.6360730415,4775854.499015297&TRANSPARENT=TRUE&EXCEPTIONS=application/vnd.ogc.se_image&width=1231&height=621
Furthermore, the use of *.png format for receiving images from the Internet, by setting properly the WMS connection, provides a great quality of the received image at the expense of slightly increase the waiting time in the response of servers.

2.2.4.3. ORTHOPHOTOGRAPHY ON THE FLY (2D)

It is also possible to present us with the area corresponding to the window you want to view orthorectified. In this case, the server that is responsible for conducting the orthorectification of the area requested at the time that comes. Due to this working mode, this visualization is also called Ortophotography on the fly, or summarized, OrtoOnTheFly.

The image obtained using this mode is treated with a real immediate orthorectification process whose used orientation data can have two origins:

- If using only the GPS / INS orientation data from the airplane which performs the photogrammetric flights, the result will has less accuracy than the results obtained after a complete aerotriangulation process. However, this is an extremely fast method which allows the server to send the images only a few days after the photograms gathering.

- When the data from a complete aerotriangulation has been already delivered by the company which processes the photogrammetric flight, it can be used to generate a most accurate orthorectification, by replacing the GPS / INS orientation data.

To achieve this it is only necessary to use the adequate STYLES parameter in the WMS request: STYLES=SGD_StereoModel::OrtoOnTheFlyOn.

The following image is an example of viewing a photogrammetric flight showed as orthophotography using the orthorectification on the fly method:
Stereoscopic images through WMS services

The ortorectified images may overlap with any other mapping information.

3. EXAMPLE OF GETMAP REQUEST

The GetMap request is composed by several parameters, ISO19128 included, separated by the symbol &. In the following lines, a usually GetMap request to a WMS service derived from StereoWebServer is described, by using the following example of a photogrammetric flight showed as an anaglyph image:

```
```

Figure nº 11: WMS request in orthophotography on the fly mode.

```
http://euskadi.sigrid.es/SgdWms/SgdWmsEuskadi.dll/WMS?&VERSION=1.1.1&REQUEST=GetMap&LAYERS=EUSKAD12011&FORMAT=image/jpeg&SRS=EPSG:25830&STYLES=SGD_StereoModel::ShowAnaglyphicOn|SGD_StereoModel::OrthoOnTheFlyOff&BBBOX=526061.112599632,4744248.6360730415,4775854.499015297&TRANSPARENT=TRUE&EXCEPTIONS=application/vnd.oasis.opendatacubemapimage&width=1231&height=621
```

```
http://euskadi.sigrid.es/SgdWms/SgdWmsEuskadi.dll/WMS?&VERSION=1.1.1&REQUEST=GetMap&LAYERS=EUSKAD12011&FORMAT=image/jpeg&SRS=EPSG:25830&STYLES=SGD_StereoModel::ShowAnaglyphicOn|SGD_StereoModel::OrthoOnTheFlyOff&BBBOX=526061.112599632,4744248.6360730415,4775854.499015297&TRANSPARENT=TRUE&EXCEPTIONS=application/vnd.oasis.opendatacubemapimage&width=1231&height=621
```

```
http://euskadi.sigrid.es/SgdWms/SgdWmsEuskadi.dll/WMS?&VERSION=1.1.1&REQUEST=GetMap&LAYERS=EUSKAD12011&FORMAT=image/jpeg&SRS=EPSG:25830&STYLES=SGD_StereoModel::ShowAnaglyphicOn|SGD_StereoModel::OrthoOnTheFlyOff&BBBOX=526061.112599632,4744248.6360730415,4775854.499015297&TRANSPARENT=TRUE&EXCEPTIONS=application/vnd.oasis.opendatacubemapimage&width=1231&height=621
```

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Figure n° 12: result of the WMS GetMap request. As can be seen, the contour lines of the DTM and a graphic scale bar are overlapping the anaglyph image.

- **http://euskadi.sigrid.es/SgdWms/SgdWmsEuskadi.dll/WMS?:** URL to the service which is connected by the client.

- **VERSION=1.1.1:** version of WMS standard used in the request. In this case, 1.1.1. It can also be 1.3.0.

- **REQUEST=GetMap:** type of request.

- **LAYERS=EUSKADI2011:** layer which is required to see; if are more than one, are separated by commas.

- **FORMAT=image/jpeg:** format of the received image. If is required to show any other overlaid layer, the adequate will be one transparent format. The supported formats are *.jpeg, *.gif and *.png.

- **SRS=EPSG:25830:** shows the CRS in which the image will be received. In this case, according to the EPSG code [http://spatialreference.org/], ETRS89 UTM zone 30 N.

- **STYLES=| SGD_StereoModel::ShowAnaglyphicOn | SGD_StereoModel::OrthoOnTheFlyOf f:** this Styles parameter is the most important in a StereoWebServer service. It is composed by one or more name of styles. Using this parameter, the user client can request the server with an anaglyph image, false colour or / and orthophotography on the fly modes, etc., also any combination thereof included. These multiple use of styles and combinations of them constitutes other of the innovations introduced by Sigrid S.L. to the development of WMS standard.

The styles used by StereoWebServer are the following:
Stereoscopic images through WMS services

- **SGD_ViewOptions::IrRG**: the image is served in false colour (IrRG) mode, if the WMS service is capable for it.
- **SGD_StereoModel::ShowContour**: this style overlay the image with contour lines from the Digital Terrain Model used when the View was configured in SigridMap.
- **SGD_StereoModel::ShowAnaglyphic**: the image is served in anaglyph mode.
- **SGD_StereoModel::OrthoOnTheFly**: the image is served with an orthorectification on the fly, as explained before.
- **SGD_ViewOptions::RasterInvisible**: turns the raster maps from WMS service into invisible.
- **SGD_ViewOptions::VectorInvisible**: turns the vector maps from WMS service into invisible.
- **SGD_ViewOptions::DrawGraphScale**: shows a graphic scale bar at the bottom of the image.
- **SGD_StereoModel::UseSurfaceModel**: uses a Digital Surface Model (DSM) if this possibility is available.

Options related to mirrored 3D visualization (falling into disuse):
- **SGD_StereoModel::MirrorVerLeftImage**: vertical mirror at the left image;
- **SGD_StereoModel::MirrorVerRightImage**: vertical mirror at the right image;
- **SGD_StereoModel::MirrorHorLeftImage**: horizontal mirror at the left image;
- **SGD_StereoModel::MirrorHorRightImage**: horizontal mirror at the right image.

Other options: **SGD_StereoModel::ShowGridPoint** (overlays the DTM data as grid of points); **SGD_ViewOptions::DrawVertex** (shows the vertex of the vector lines); **SGD_ViewOptions::DrawExtremes** (shows the extremes of the vector lines); **SGD_StereoModel::SwapImages** (swaps the right and left images from the stereoscopic pair); **SGD_StereoModel::AdjustToFlyDirection** (sometimes, the photogrammetric flight does not follow the traditional East - to - West course; instead, it may, for example, follow a North - to - South course, making the stereoscopic model incorrectly created causing the deformation of the 3D vision. The user can choose the correct direction for the visualization by activating this style).

![Figure n° 13 Adjust to Fly Direction.](image-url)
Stereoscopic images through WMS services

StereoWebServer allows the user to combine several styles in one request using the OR operator (symbol). In this way, in the example showed above, two style names are combined, separated by symbol:

SGD_StereoModel::ShowAnaglyphicOn | SGD_StereoModel::OrthoOnTheFlyOff

Furthermore, these styles can be activated or deactivated by finishing the name of the style with On or Off respectively:

STYLES = SGD_ViewOptions::RasterInvisibleOn
STYLES = SGD_StereoModel::ShowAnaglyphicOff

- **BBOX=526061.112599632,4744248.688067064,527179.2193580456,4744565.9590659**
  - 504: X and Y coordinates (in the selected CRS) from the bottom left corner and the upper right corner of the specified window for the map.

- **TRANSARENT=TRUE**: transparency of the image.

- **EXCEPTIONS=application/vnd.ogc.se_image**: if the application fails, an image is sent by default.

- **width=1022, height=290**: shows the dimensions (width and height) of the image sent by the server, measuring in pixels.

Accompanying the image, it is also sent a cookie which defines the parameters for the establishment of an adequate comparison plane which allows the server to display the 3D image optimally. This comparison plane is defined at the medium altitude value of the created stereoscopic model.

In this case, the contents of the cookie associated with the aforementioned GetMap example is:

Georeference2

x00=526395.055&y00=4743827.32783273872.83&80=1,0,0,0,1,0,0,0,
1&tx=0=305.725111403273&ly0=675.252939137013&x01=526912.031&y01=474382
5.359&x2=0=4393.88&d=1=3873.78&1=1,0,0,0,1,0,0,0,0,0,1&tx1=778.268401752974&ly
1=677.053613641378&tx2w=-
480846.0001431&tyc2w=4336760.9931604841&0=0.914050621590198,0,0,-
0.9140479717590698&z=520&ph1=3093&ph2=3092

For to consult the whole information about parameters, styles and cookies created with the aim of give more utilities to StereoWebServer, see also the chapters 4 and 6 from the Annex II, where is fully described the configuration of the server.
4. ADVANTAGES OF STEREOWEBSERVER

Other map servers can provide the users with 2D raster or vector information. **StereoWebServer** is also capable of supplying all the data from the photogrammetric flights and synthetic stereoscopic through the Internet. It has several advantages:

- **Cost**: once the photograms are processed, to make them available is a simply and cheap step. This process is very cost effective because the data are reused, thus getting a new profit of them.

- **Immediacy**: if the photogrammetric flight has been produced using GPS/INS systems, the data can be available (e.g. as orthophotography on the fly) only a few days after its gathering. In cases such as risk assessment, time is essential.

- **Stereoscopy**: the photograms and the images created using synthetic stereoscopic technique can be viewed in s3D stereoscopic mode, providing additional information in photo interpretation. In addition, the user can see whole pieces of territory in a continuous form, being unnecessary to compose the stereoscopic pair as was common when the ancient stereoscopes were used.

- **Accuracy**: due to the use of photogrammetric data, the derived products and services offers the same metric rigour, in such a way it can be used for restitution.

The ability to managecartography in s3D stereoscopic mode through the Internet makes **StereoWebServer** a powerful tool for photo interpretation and other tasks related to the observation of territory such as:

- Zoning.
- Geological and geomorphological analysis.
- Risk assessment (erosion, landslide, etc.).
- Design of telecommunication and power line networks.
- Agriculture and environmental studies.
- Preliminary project drafts of public works.
- Tourism and presentations or exhibitions.
- Etc.
5. CONCLUSION

In conclusion, this report gives the most important information about the operation of StereoWebServer, an Internet map server developed by Sigrid S.L. focuses on sending data from photogrammetric flight and stereoscopic images through the Web.

In order to achieve these purposes, has been necessary to implement two solutions for to solve the problem of sending stereoscopic images using a GetMap request:

- **Real s3D**: the double - wide images are not described by OGC™ WMS standard so new specific WMS clients based in OpenGL have been developed.

- **Anaglyph s3D**: it is a solution which allows Sigrid S.L to adapt the OGC™ WMS standard and show the images in any WMS client.

In addition, other utilities have been implemented in StereoWebServer, using a wide range of styles which enable users to make the most of the photogrammetric flights, including visualize data from DTM, the false colour mode or the orthorectification, among others.

6. REFERENCES

- **WMS standard from Open Geospatial Consortium ® (OGC™):**
  
  http://www.opengis.org/standards/wms

- **Technical Guidance for the implementation of INSPIRE View Services:**
  

- **OGC Market Report Open Standards and INSPIRE:**
  
  http://www.opengis.org/pressroom/marketreport/inspire

- **Spatial Reference Systems:**
  
  http://spatialreference.org/ref/epsg/

- **StereoWebMap - SIGRID S.L. blog:**
  
  http://blog.sigrid.es/

- **SIGRID S.L. web page:**
  

- **STEREOWEBMAP web page:**
  
- **SIGRID MARKET web page** (from this webpage, we can provide the users with anaglyph glasses):
  

- **SIGRID CARTOGRAFÍA channel in YouTube**:
  
  [http://www.youtube.com/user/SigridCartografia](http://www.youtube.com/user/SigridCartografia)

- **Social networking**:

  FACEBOOK 📱: [https://www.facebook.com/stereowebmap](https://www.facebook.com/stereowebmap)

  TWITTER 📱: [https://twitter.com/StereoWebMap](https://twitter.com/StereoWebMap)


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