3D Digital Map (AW3D) and MDRU for disaster management

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Introduction

Many disasters in the world
- eg. Great East Japan Earthquake in March of 2011
  - In disaster areas, no network resources were available soon after the disaster other than the cellular network.
  - Many victims couldn’t use even mobile phones due to congestion in cellular network.

Lessons learned that disasters render it impossible to provide basic ICT services.

Importance of ICT for disaster management
- Movable and Deployable ICT Resource Unit (MDRU)
- 3D Digital map for preparing disaster management plans
Content

- High-resolution 3D digital map (AW3D) for disaster management

- Movable and deployable ICT resource unit (MDRU) for ordinal use

- Conclusion
3D digital map (AW3D)
Global High-resolution 3D Map: “AW3D®”

AW3D is the world’s most precise pre-produced global digital 3D map covering all global land spaces with 5 meter resolution. This service offers a high-definition and high-resolution 3D map at 0.5 meter to 2 meter resolution.

AW3D is used for planning grand design of telecommunication equipment such as base stations of 5G mobile networks.

- World’s first 5m global 3D map
- Utilized in more than 115 countries/areas, 900 projects.
- Applied in many fields, including telco and disaster mitigation.
- Up to 0.5m data in some areas
- Telecomunications
- Disaster mitigation

Cutting edge algorithm x Big-data advanced processing
Use case of Global High-resolution 3D Map

AW3D, high-resolution map data in 1/2500 scale, can be utilized for following areas instead of aerial surveillance or field investigation by means of high-resolution, cost merit, wide coverage and safety.

**Develop Map**
- Contour map
- Detecting changes of land

**Urban development**
- Land formation
- Landscape/sunshine simulation
- Wind analysis

**Plant/Building management**
- Land formation
- Selection location
- GIS data for plant/building management

**Airport/Port**
- Selection location
- Map of assets (AMDB)
- Flight hazard

**Agriculture**
- Irrigation design
- Pond investigation
- Sloping terrain

**Electricity**
- Estimation of construction areas
- Selection cable route
- Selection power plant location (geothermic, wind)

**Train/Road**
- Route selection
- Estimation construction cost
- Relocation citizens

**Disaster management**
- Hazard map
- 3D disaster information
- Damaged area

**Forest management**
- Open space plan
- Deforestation
- Tree height, forest size
Hazard map to clarify high-risk areas

3D map data enables to clarify high-risk areas in the case of disasters by using existing hazard maps. It can be utilized in disaster simulation at specific areas.
Visible 3D disaster information

Simulated disaster affected areas in the case of disaster can be visible by prediction combined 3D map data and existing hazard map of landslide or flood.
(Use case) Visible predicted disaster images

Predicted disaster images or movies based on 3D map data can share risk information of disaster damages/affected areas within citizens and government officials.
DioVIStA of Hitach power solutions can analyze flood areas based on AW3D.
Use cases of 3D map for disaster management

AW3D data set, which covers wide area with high-resolution, can be the base data (map) for planning several disaster management operations.

<table>
<thead>
<tr>
<th>Disaster management operations</th>
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</thead>
<tbody>
<tr>
<td>Mapping BSs</td>
</tr>
<tr>
<td>No of affected houses</td>
</tr>
<tr>
<td>Dangerous area</td>
</tr>
<tr>
<td>Disaster affected area</td>
</tr>
<tr>
<td>Disaster mgt planning</td>
</tr>
<tr>
<td>Hazard map</td>
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<tr>
<td>Flight mgt of Heli &amp; drone</td>
</tr>
<tr>
<td>Landing area of Helicopter</td>
</tr>
<tr>
<td>Radio propagation</td>
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<tr>
<td>Visual analysis</td>
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</tbody>
</table>

- High-resolution image
- High-resolution landscape data
- Flight hazard data

AW3D data set
Emergency telecommunication system (MDRU)
Movable and Deployable ICT Resource Unit

Portable IP phone system (MDRU)

- IP-PBX Main Unit
- Wireless LAN Access Point (Wi-Fi Connections)
- Battery (for IP-PBX)
- Smartphone (option)
- VoIP Gateway (for Analogue Telephone)

**Rack mount type MDRU**
A high performance type mounted on 19-inch rack realizes comparability to a data center.

**Automobile type MDRU**
All equipment including power supply are installed in the vehicle, providing excellent mobility that can move anywhere immediately.
Use case of MDRU in disaster areas

**Situation:** Telecommunication and electric power **blackout** due to infrastructure damages by disasters

**Solution:** Communication through MDRU between staffs and evacuees at the Local centers, Disaster affected area, Administrative headquarters etc.

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- Telecommunication and electric power blackout due to infrastructure damages by disasters

**Solution:**
- Communication through MDRU between staffs and evacuees at the Local centers, Disaster affected area, Administrative headquarters etc.

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**Diagram:**
- Portable IP-PBX (MDRU)
- External call
- Internal call
- Long distance (1km) wireless LAN access point (Option)
- Satellite telephone network
- Modular jack (RJ-11)
In 2016, ITU-T Recommendation L.392: Disaster management for improving network resilience and recovery with movable and deployable information and communication technology (ICT) resource units.
Use case of eEducation in rural areas of Nepal

- In Nepal, there are many people who want to learn primary education as they can’t (couldn’t) go to elementary school due to personal, family and geographical reason.
- Ordinal use of emergency telecommunication system can be utilized for providing education, so Nepal and Japan conducted pilot projects on e-Education by MDRU.
- Lessons that teacher offers in main venue are shared with participants in multiple remote venues by using teleconference, SMS and file sharing functions offered by MDRU.

<table>
<thead>
<tr>
<th>Trial case</th>
<th>Value</th>
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<tbody>
<tr>
<td>Num. of communities connected</td>
<td>3</td>
</tr>
<tr>
<td>Num. of participants per community</td>
<td>20</td>
</tr>
<tr>
<td>(10 to 30)</td>
<td></td>
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<tr>
<td>Total Num. of participants supported by one MDRU</td>
<td>60</td>
</tr>
</tbody>
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<table>
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<tr>
<th>Potential needs</th>
<th>Value</th>
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<tr>
<td>Num. of communities in Nepal</td>
<td>About 3750 (From 3000 to 4500)</td>
</tr>
<tr>
<td>Num. of typical cases in Nepal</td>
<td>About 1250 (Market scale)</td>
</tr>
</tbody>
</table>
Jholunge Village, Sindhupalchowk

Remote venue A (500m from school)
- 10 Children for elementary education
- 10 Adults for agricultural consultation

Remote venue B (1km from A)
- 10 Children
- 10 Adults

Elementary School
- Teacher
- 20 Children
Results of eEducation pilot

- Based on survey of questionnaire, most of participants satisfied eEducation using MDRU. Especially, adults scored only good, very good and excellent.
- Results show that eEducation, including agricultural consultation, by using MDRU is effective. It was expected to prepare dedicated applications for each user.
Conclusions
- Natural and/or human disaster may occur anywhere in the world, even in your country.
- Landscape is always changed year and year.
- Preparing disaster management plan based on actual geographical information in advance is effective to save people lives and to reduce asset losses and damages.

High-resolution 3D digital map helps to prepare disaster management plans based on actual geographical information in advance.
- Ordinal use of disaster management system such as emergency telecommunication system is important.
- eEducation in rural area can be provided by MDRU.
- Nepal and Japan conducted pilot project on eEducation using MDRU at Jholunge Village of Nepal in Feb 2019.

- **MDRU** as emergency telecommunication system can be utilized for **eEducation** or **eAgriculture** in rural areas where telecommunication infrastructure is insufficient.
- Ordinal use of MDRU might be considered as disaster drills, so the skills must elicit an effect in the case of disaster.
Backup slides
Actual use case of MDRU at Kumamoto earthquakes

ICT unit with NICT’s vehicle-mounted satellite base station

Residents using the Internet to collect information in a shared space

Internet-access service

ICT unit with Docomo’s satellite-based mobile phones

Voice call service

Staff member using his smartphone to make a call via satellite at his desk

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