Kartiranje in monitoring iz letalskih posnetkov v realnem času
Airborne real-time mapping and monitoring

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POVZETEK

V primerih dogodkov velikega obsega ali nesreč potrebujejo javni organi in organizacije, ki so pristojni za varnost in promet, točne in zanesljive podatke, ter informacije o trenutni situaciji. Na podlagi teh informacij se pristojni organi hitro odločajo kako varno in učinkovito ravnati v dani situaciji upoštevajoč dana sredstva. Posebno pomembne so informacije o prometni mreži in trenutnem stanju prometa, ker je mobilnost ekip nujne pomoči bistvena za hitro razrešitev situacije.

VABENE++ je ime projekta, ki se ukvarja z upravljanjem podatkov o prometu pri dogodkih velikega obsega in katastrof. Za te namene se razvijajo metode in orodja za zajem podatkov, zaznavanje informacij iz različnih virov, ki omogočajo osnovo za odločanje in tudi porazdelitev teh informacij in podatkov. Projekt je financiran s strani Nemške Vesoljske Agencije (Deutsches Zentrum für Luft- und Raumfahrt, DLR). Letalski posnetki omogočajo hitro presojo situacije obravnavanega ali prizadetega območja in so zato primerni za odločitve o pomoči v primerih nesreč. 4k sistem kamer, razvit na DLR-ju, sestavljajo trije standardni nemetrični fotoaparati, od tega je en usmerjen v nadir, druge dva pa poševno. Ta sistem kamer je mogoče namestiti v smeri leta ali pravokotno na smer leta na dve raziskovalni letali, to sta Cessna 208B Grand Caravan in Dornier DO228-212. Rezultat nadaljnjega razvoja 4k sistema je sistem, ki ga je možno namestiti na helikopter BO 105. Posebnost tega sistema je, da kamera, ki je usmerjen navpično, zajema HD video posnetke v realnem času.

Zajeti posnetki so geoereferencirani v realnem času na podlagi GPS/IMU podatkov in ortorektificirani z uporabo digitalnih modelov reliefa. Glede na podatke in informacije, ki so potrebni za določen namen, je možno na krovu letala izvesti dodatne tematska obdelave posnetkov, kot na primer avtomatski zajem podatkov o prometu. Nato so ti obdelani posnetki in informacije prenešeni preko mikrovalovne podatkovne povezave na zemeljsko postajo in pripravljeni za uporabnike. Hrbtenica verige za samodejno obdelavo podatkov je platforma za podatke o prometu (TDP), kjer so zbrani in shranjeni vsi zajeti posnetki in izvedeni podatki o prometu. Vsi dostopni podatki so med seboj povezani in združeni z namenom, da se pridobi celostni pregled nad obravnavano situacijo in območjem. Obstajata dve vrsti TDP-ja, statična (sTDP) in mobilna (mTDP). sTBP se uporablja v mobilni zemeljski postaji za sprejem podatkov, medtem ko je sTDP znotraj omrežja DLR-ja. Če obstaja internetna povezava se mTDP sinhronizira s centralnim sTDP-jem.

Spletni portal je primer podpornega sistema za pomoč pri odločanju organom, pristojnih za varnost in promet. Ta portal omogoča prikaz podatkov in združevanje zračnih posnetkov zajetih v realnem času s podatki o nadzoru prometa iz terestričnih sistemov. Omogoča tudi oceno trenutnega stanja prometa, prognoze prometa in simulacije za napoved odsekov, kjer je pričakovano zgoščevanje prometa, na primer v primerih evakuacije ali za logistično usklajevanje reševalnih enot.

Visoka stopnja avtomatizacije poteka procesov v sistemu VABENE++ omogoča dostopnost do podatkov v realnem času. Mobilna zemeljska postaja in možnost vgraditve sistema v dve letali, kot tudi v helikopter, omogoča uporabo sistema v različnih situacijah, od kartiranja, preko sledenja vozilom in določanja situacije v prometu. Sistem deluje zanesljivo, kar je bilo preizkušeno v različnih scenarijih. Na podlagi posnetkov in informacij pridobijo pristojni organi dodatne zanesljive podatke, na podlagi katerih lažje sprejemajo odločitve.

KLJUČNE BESEDE: zaščita in reševanje, realen čas, kartiranje, letalski sistem, nadzor prometa

ABSTRACT

In cases of large scale events and disasters public offices and organizations with security responsibilities as well as traffic authorities need accurate and reliable information for situation awareness. These pieces of information are used by the authorities to quickly meet decisions in order to safely and efficiently manage such events with the given resources. Particularly, information on the transportation system and traffic are of great importance, because the mobility of the public and relief teams is crucial for fast disaster relief.

The VABENE++ Traffic Management for Large Scale Events and Disasters is a project of the German Aerospace Center (DLR) to develop tools for data acquisition, information extraction from several sources, decision support, and data distribution. Aerial images enable fast assessment of the situation of the target area and are therefore well suited for disaster relief applications. Each of the 4k camera systems, developed by the DLR, consists of three non-metric off-the-shelf-cameras, of which one is nadir looking, and two are side-wards looking. The 4k system can be mounted in along-track or across-track mode, in the two research aircrafts, Cessna 208B Grand Caravan and Dornier DO228-212. The camera system was further developed and implemented as a 4k camera system, which can be mounted on a helicopter BO105. The 4k system can acquire real time HD video with the nadir camera.

As soon as the images are acquired, they are georeferenced with a real time GPS/IMU data and orthorectified using digital elevation model. According to the required information, additional thematic processing aboard is carried out, such as automatic traffic information extraction. Then, the images and extracted information are transmitted over a microwave data link to the ground station and distributed to the end users. The main backbone of the processing chain is the traffic data platform (TDP), where all acquired data and extracted traffic information and derived products are centrally stored. All the available data are combined to gain an overview of the situational information. The TDP is realized as a mobile mTDP or stationary sTDP. The former is used in mobile ground stations and the latter is centrally hosted at the DLR. The mTDP synchronizes with the sTDP whenever the internet connection is available.

One example for a support system for decision makers, such as rescues forces and traffic management, is a web-based portal. It combines real-time aerial and ground-based traffic monitoring data and visualizes them. The

traffic state is estimated and additionally, the traffic prognosis and simulations are computed to identify possible bottleneck places, e.g. in evacuation scenarios or for the logistics of the rescue forces.

The VABENE++ system ensures real-time data availability through high degree of automation of the entire workflow. The mobile ground station and several platforms, on which the camera system can be mounted, enable usage of the complete system in various scenarios, from mapping applications to the vehicle tracking and traffic situation assessment. It was shown through several field-tests that the system works reliably and can serve as additional source of information for decision makers.

KEY WORDS: civil protection, real time processing, mapping, airborne system, traffic monitoring

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