

## 5 Conclusion

We live in a time when the Internet and digital technologies are engaged in all aspects of human life and activity. Access to high-speed broadband Internet is no longer limited to desktop and laptop computers, but has become available to ubiquitous smartphones. So we are no longer forced to perform our daily on-line activities from our cosy homes, but can go online at any time and anywhere by means of our mobile phones. Keeping records or a log on-line is no longer a novelty, but has de-

veloped into a trend in most areas of human life and activity. Another example of this development is the CARNet *e-Dnevnik* project, intended to replace gradually existing textbooks in Croatian primary and secondary schools. In this respect, the newly developed *HPO e-Log* - photographs of hikers at checkpoints is a significant step forward in recording and monitoring statistics of visits to HPO checkpoints and it is completely end-user-friendly. It is available at <http://hpo.hps.hr/>, and can also be accessed via the link installed on the Mountaineering portal.

The *HPO e-Log* was approved by the HPS Hiking Trails Commission and presented to a wider mountaineering public (Kristijan 2015, Tomac, Špoljarić 2015, URL 6). Many hikers have welcomed the opportunity of logging in, entering their photographs, and proving their visits to HPO checkpoints.

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## 3D Mapping with Google Smartphones

Google's Project Tango could revolutionize mapping and navigation. In a narrower sense, it is a software platform for augmented reality based on computer vision. In February 2014, Google announced they were developing a prototype smartphone, based on their operating system Android, which was going to be able to map 3D space in which we move and simultaneously determine our position. One of project Tango's main objectives is to create detailed maps of indoor spaces (indoor mapping) in order to facilitate indoor and outdoor (in combination with Google Maps) navigation. Another important use of the technology which motivated Google's developers are augmented reality applications in the gaming industry and products marketing.

It is anticipated the smartphone is going to have built-in sensors (one or more cameras, depth sensor, etc.),

which are sufficient to make use of the simultaneous localization and mapping (SLAM) in real time. With this configuration, one can map in detail his or her immediate environment and determine position. The sensors are going to be able to carry out hundreds of thousands of measurements every second, creating point clouds representing the surrounding area. SLAM technology has been developed in the context of robotics for a long time, and it is going to have a broad range of application once it becomes available on smartphones. By creating an extremely detailed map of the world, particularly indoor spaces, a smartphone can provide detailed instructions to navigate to any point. This could help the visually impaired to move in areas they had never been in (Maxwell 2014). According to Tango project manager Johnny Lee, one of Google's visions is the ability to search the real world

similarly to how it is now possible to search the Internet (Nieva 2016).

Google's open source project Cartographer is an example of software utilizing the SLAM technology. It contains a collection of programs for simultaneous localization and mapping in real time. SLAM technology works with ROS (Robotic Operating System) and can be applied to robots, unmanned aerial vehicles and self-driving cars. Currently, Cartographer is focused on LIDAR SLAM, but is planned to include other sensors and platforms (Iyer 2016).

Chinese company Lenovo introduced smartphone Phab 2 Pro with a 6.4-inch screen and built-in Tango technology priced at \$500 in June 2016. It was scheduled to appear in September 2016 (Nieva 2016). According to Lenovo, the phone is going to be available on December 24, 2016. (Lenovo 2016).

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planinarskoj javnosti (Kristijan 2015, Tomac, Špoljarić 2015, URL 6). Mnogobrojni su planinari prihvatili tu mogućnost dokazivanja posjeta KT HPO-a, registrirali se i unose svoje fotografije u digitalni dnevnik.

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## 3D kartiranje Googleovim pametnim telefonima

Googleov projekt *Tango* mogao bi revolucionirati način kartografiranja i navigacije. U užem smislu, riječ je o softverskoj računalnoj platformi za proširenu stvarnost koja se temelji na računalnom vidu. Google je u veljači 2014. najavio da radi prototip pametnog telefona, zasnovanog na vlastitom operacijskom sustavu Android, kojim je moguće u 3D kartirati prostor kojim se krećemo uz istodobno određivanje našeg položaja. Jedan od glavnih ciljeva projekta *Tango* je kreiranje detaljnih karata zatvorenih prostora (*indoor mapping*) koje bi povezivanjem s Google Mapsom omogućile navigaciju u otvorenim i zatvorenim prostorima. Jednako važne primjene te tehnologije koje motiviraju Google na njezin razvoj su proširena stvarnost s primjenama u industriji računalnih igara i prodaji proizvoda.

Predviđeno je da pametni telefon ima ugrađene senzore (jednu ili više kamera, senzor dubine, itd.) koji su dovoljni da se primjenom istodobnog pozicioniranja i kartiranja (*simultaneous localization and mapping* – SLAM) u stvarnom vremenu može detaljno kartirati neposredna okolina i odrediti vlastiti položaj. Ti senzori obavit će

stotine tisuća mjerenja svake sekunde stvarajući oblake točaka koji prikazuju okolni prostor. Navedena tehnologija koja se već dulje vrijeme razvija u okviru robotike, sada dostupna i na pametnim telefonima, ima velike mogućnosti primjene. Kreiranjem ekstremno detaljne karte svijeta, posebno zatvorenih prostora, pametni telefon može dati detaljne upute za kretanje do bilo koje točke. Time bi se moglo pomoći i slabovidnim osobama da se kreću prostorima u kojima nikada nisu bili (Maxwell 2014). Jedna od vizija Googlea vezana uz tu tehnologiju, prema riječima Johnnya Leeja, voditelja projekta *Tango*, je i mogućnost pretraživanja stvarnoga svijeta, kao što je to sada moguće za internet (Nieva 2016).

Jedan od softvera koji podržava navedenu tehnologiju je i Googleov projekt otvorenoga koda *Cartographer* koji sadrži zbirku programa za istodobno pozicioniranje i kartiranje (SLAM) u stvarnom vremenu. Ta tehnologija koja radi s operacijskim sustavom otvorenoga koda ROS (*Robotic Operating System*) može se primijeniti u robotima, bespilotnim letjelicama i automobilima bez vozača. Trenutačno,

*Cartographer* je fokusiran na LIDAR SLAM, ali je predviđeno da uključi i druge senzore i platforme (Iyer 2016).

Kineska tvrtka Lenovo predstavila je u lipnju 2016. pametni telefon Phab 2 Pro sa 6,4 inčnim ekranom i ugrađenom tehnologijom *Tango* cijene 500 USD. Na tržištu bi se trebao pojaviti u rujnu 2016 (Nieva 2016). Prema najavi iz Lenova telefon će se pojaviti u prodaji 24. prosinca 2016. (Lenovo 2016).

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