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High precision GNSS in autonomous driving

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Self-driving cars are able to sense their surroundings and navigate in it with the help of radar, lasers, computer vision and GNSS. The perceived information is used to plan routes and navigate between the various elements of transport.
GPS devices make navigation easier for vehicle drivers. Although they help to reach our destination, today's system works with an error of several metres. Due to this difference GNSS data can only complement the work of sensors in self-driving cars. The testing phase of autonomous systems faces some complications in dense cities. The extremely high DOP (dilution of precision) values usually refer to building-blocked signals.
However, accurate information about the current position of the vehicle are essential for cars in traffic. Human drivers complement the deficiency of GPS with the knowledge on traffic rules and signs. The sensor-based evaluation of the surroundings is a vulnerable process in autonomous traffic, but high precision GNSS and background GIS databases can make it safer.
In our project we have used a real-time kinematic (RTK) GPS system that is able to reach centimetre-level accuracy. The sample area is a part of the downtown of Budapest, Hungary. Here all the relevant traffic signs, lights and pedestrian crossings were located. A preliminary database has been set up from the measured points. As self-driving cars need precise position data of these terrain objects, we have tried to work with a maximum error of a few decimetres.
We have inserted our data into Postgres/Postgis spatial database system. With this we plan to solve sudden and dangerous situations. If the camera of the car does not see a traffic sign because of another object, information about it will be available from the database. If a pedestrian crossing is hardly visible and the sensor does not recognize it, the background GIS data will warn the car that there may be inattentive people around. An application has also been developed that we will test: it will be able to observe GPS accuracy in the recognition of the located signs during driving through the sample area.
The main aim of this research is to achieve safer autonomous driving circumstances. A refreshable cartographic GIS database in the car memory is an additional device that ensures smaller human life risk. The future maintenance of this data system is also in our hands: human work can be replaced by point cloud analysis and later by the updating work of self-driving cars.

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