

The Service Scenario of Road Environment Improvement Based on Crowd Sourcing for Smart City

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Abstract— This paper proposes the service scenario based crowd sourcing for improving the problems of city. The purpose of “The service scenario of road environment improvement based on crowd sourcing” collects and monitors diverse road environment information that is reported from mobile situations to civic participation, and provides immediate resolution to help prevent inconvenience to residents and secondary accidents.

Keywords— smartcity, crowdsourcing, illegal parking, pothole

I. INTRODUCTION

There's a growing interest in smart cities around the world, and the EU, Japan, and the United States have aggressively invested in technology. The China and India are presenting smart city as a national agenda for urban innovation. The South Korea is also striving to prepare countermeasures for preoccupation. With the concentration of cities, various issues such as increased traffic congestion, increased energy consumption, and lack of water are occurring in areas such as transportation, safety, economy, environment/energy, life/welfare, and administration. Various smart city demonstration projects such as U(Ubiquitous)-City and IoT(Internet of Things) have been carried out, but due to low public sentiment and low practical contributions to city operation management, improving them, and establishing a leading smart city model for civic participation. This paper proposes “the service scenario of road environment improvement based on crowd sourcing”. The scenario collects and monitors diverse road environment information that is reported from mobile situations to civic participation, and provides immediate resolution to help prevent inconvenience to residents and secondary accidents.

II. RELATED RESEARCH

The MSIT(Ministry of Science and Information and Communication Technology) has established an IoT demonstration complex with the goal of creating a brand new market. One of the projects is the Global Smart City Demonstration Projects which have organized a consortium tasked with studying and applying smart city technologies in

four fields and 16 services in the Haeundae district of Busan[1][2]. But the project concentrates on building infrastructure and providing services based IoT demand.



Figure 1. Korean Global Smart City Project(source:<http://k-smartcity.kr>)

The Giga Korea Foundation(GKF)[3] under MSIT has created the project with Image-based smart city service. It provides to users by building up the 3D smart city information gathered from various images such as vehicles or CCTVs as high precision/real-time. It is utilized as an information infrastructure of 5G based services such as autonomous driving or AR(Augmented Reality) service by monitoring more accurate situation information within the smart city after combining indoor and outdoor image information. Image-based city danger avoidance service precisely recognizes the dangerous situations with real-time combination of images to protect pedestrians in crosswalk. It receives danger factors as images to determine proximity with the current location and danger level.

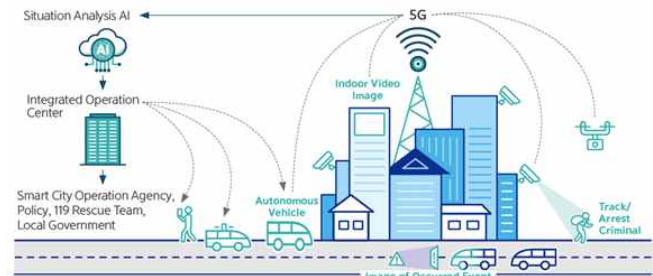


Figure 2. Smart City Project by Giga KOREA Foundation
(source:<http://www.gkf.kr>)

The ETRI(Electronics and Telecommunications Research Institute) is working on a project that meets the requirements on the GKF. The name of the project is “Development and Demonstration of Smart City Service over 5G Network”.



Figure 3. Smart City Service Project over 5G Network(source:<http://www.etri.re.kr>)

The purpose of the project is developing and demonstrating the core technologies of smart city service platforms that can support the safe, convenient, smart life and support urban competitiveness by utilizing 5G convergence technologies of mobile communications and ICT and urban infrastructure services, as shown in Figure 3.

The project includes the four smart city service scenarios for demonstrating the core technologies with local autonomous entities, such as Daejeon and Daegu cities. The one of the smart city service scenarios is called “Road environment improvement and information sharing scenario based on crowd sourcing”. The scenario is explained in detail in the following chapter.

III. THE SERVICE SCENARIO OF ROAD ENVIRONMENT IMPROVEMENT BASED ON CROWD SOURCING

The application of irregular living report made by the MOIS(Ministry of the Interior and Safety) provides the for illegal parking report function. But, there is an inconvenience in having a person take two pictures in the same place for five minutes to check illegal parking. Also, When illegal parking operators directly compare and analyse pictures of cars, they have a problem that is time-consuming and costly to judge.[4]

We propose the service scenario based crowd sourcing for improving the problems. The purpose of “The service scenario of road environment improvement based on crowd sourcing” collects and monitors diverse road environment information that is reported from mobile situations to civic participation, and provides immediate resolution to help prevent inconvenience to residents and secondary accidents.

The crowd sourcing application is normally used like a black box, then takes a picture of an illegal parking vehicle in an illegal parking area, and the illegal parking judgment is performed on the server based on deep learning. That is, by minimizing human intervention, we save time and money.

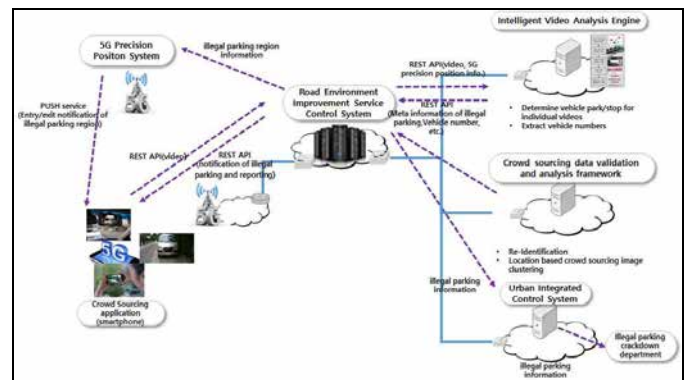


Figure 4. A service scenario based crowd sourcing for improving illegal parking

Figure 4 shows the service scenario based crowd sourcing for improving illegal parking. The detailed flow of the service scenario as follows.

- PUSH Service by mobile telecommunication provider informs user of entering illegal parking area
- The Crowd Sourcing application of user's smartphone runs automatically
- The application takes a video of illegal parking situation and sends the video file to the Road Environment Improvement Service Control System
- The Road Environment Improvement Service Control System(REISCS) again send the video file and position information and to the Intelligent Video Analysis Engine
- The Intelligent Video Analysis Engine determines vehicle park/stop for individual videos, extracts vehicle numbers, and sends meta information of illegal parking(Vehicle number, etc.) to the REISCS
- The REISCS must have illegal parking area information in database and need tool for setting illegal parking position
- The REISCS must share illegal parking area information with 5G Precision Position System[5]. The REISCS provides the first warning to the crowd sourcing participants who are judged to have been illegally placed.

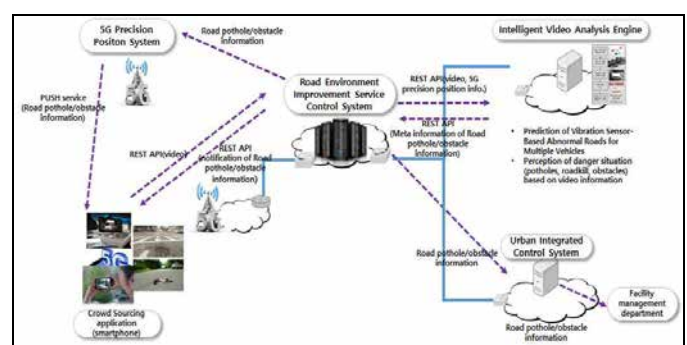


Figure 5. A service scenario based crowd sourcing for sharing potholes and obstacles information

Figure 5 shows the service scenario based crowd sourcing for sharing potholes and obstacles information. The detailed flow of the service scenario as follows.

- Users run the crowd sourcing application participate in shared services using the crowd sourcing
- The application detects vibration by potholes and obstacles
- If vibration is detected, the application cuts the video for 10 seconds (total 20 seconds) before and after the vibration and sends the video file to the REISCS
- At the same time, if the driver thinks it is a pothole or obstacles, he may push an alert button. When the button is pressed, the video is cut separately for 10 seconds (total of 20 seconds) and uploaded.
- The REISCS again send the video file and position information and to the Intelligent Video Analysis Engine
- The Intelligent Video Analysis Engine analyses danger situation (potholes, roadkill, obstacles) based on video information and predicts vibration sensor-based abnormal roads
- The Intelligent Video Analysis Engine sends the meta information of road pothole/obstacle to the REISCS
- The REISCS notifies nearby application users of real-time abnormal road conditions

Both scenarios inform urban integrated control system of illegal parking, pothole, and obstacles information. The urban integrated control system again informs the road environment information of the relevant urban departments. The relevant urban departments processes actions according to road information.

IV. CONCLUSIONS

This paper proposes the service scenario based crowd sourcing for improving the problems of city. The purpose of "The service scenario of road environment improvement based on crowd sourcing" collects and monitors diverse road environment information that is reported from mobile situations to civic participation, and provides immediate resolution to help prevent inconvenience to residents and secondary accidents. In the future, we are planning to implement this scenario and service it by applying it to the demonstration area of smart city.

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REFERENCES

- [1] Korean Global Smart City Project, <http://k-smartcity.kr>
- [2] Sung-Jin Kim, "The Development of Smart Cities and the Korean Smart City Model," KIET Industrial Economic Review, Apr. 2018.
- [3] Giga KOREA Foundation, <http://www.gfk.kr>
- [4] Safe e-Report, <https://www.safetyreport.go.kr>

- [5] POSITIONING AND LOCATION-AWARENESS IN, FUTURE 5G NETWORKS, <http://www.tut.fi/5G/positioning/>