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IoT-based automobile parking navigation platform

Total customer experience with smart integration and big data analytics

It happens to all motorists every day – we make it through a gridlock only to find the parking lot is full. We'd then continue the painful search without knowing if the same thing would happen again in the next parking lot... Not anymore of such nuisance with the IoT-based advanced automobile parking navigation developed by Dr Andrew W.H. Ip of the Department of Industrial and Systems Engineering and his research team. It is a smart system accessible with smartphone app to keep track of where the vacant parking spaces are. This is good news to all motorists enhancing driving experience in major ways.

IoT: Internet of Things

To put it simply, the sensor at every parking space tells a middleware system whether it is taken or not. The system then consolidates all info and uploads it to cloud servers. Users can then retrieve that information with smartphone app and get to know which parking lot has vacant spaces at that precise moment. They also have the option to start navigation with GPS that leads them to a particular parking lot. In those buildings with indoor positioning systems, drivers can even be guided exactly to the available or pre-assigned parking spot. The cloud servers also send data to different display boards in each parking lot to inform motorists of vacancy condition on the spot. It sounds straight forward, but only the combination of a number of advanced and mature technologies could make it happen.

First thing first, what is the Internet of Things (IoT) anyway? It is the network of physical objects that exchange data among themselves to enhance service quality and values. You heard right. We are now in the era when machines can talk among themselves, sometimes making decisions on our behalf without ourselves knowing. Dr Ip said, "The idea has been around for long, but it hasn't been really doable without the current advancement in computing speed, wireless sensor and actuator network (WSAN) and machine-to-machine (M2M) communication platforms. To implement our project, for example, huge cabling cost for connecting all sensors in a big car park would be incurred in the past. But now, there are compact sensors with Wi-Fi connectivity in the market. They simplify the whole task of building a network while keeping costs down."

Big data analytics

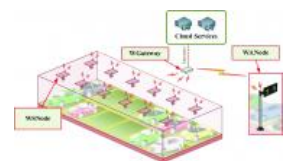
Another challenge is the sheer amount of data collected. We're talking about tens of thousands of sensors sending in data every split second. Without powerful computing tools, the analysis and organization of information take forever and by the time the result is acquired, it is no longer updated. "Making this system real-time is exactly where the challenge is. The huge amount of data has to be organized, filtered and consolidated within split second. This has not been possible until the prices of solid state memory came down recently," explained Dr Ip.

NFC-enabled CRM and others

The latest generation of smartphones usually come with Near-field Communication (NFC) functions, literally turning your phone into a smart card for various purposes. The advanced automobile parking navigation system developed by PolyU is also ready to incorporate NFC and other customer relations management (CRM) protocols. According to Dr Ip, "the simplest use of NFC is to pay the parking fee with your phone. You can also join a loyalty programme with your phone and collect points every time you park in that car park. Maybe after reaching a certain status in the loyalty programme, a user has the privilege to reserve a parking space



Dr Andrew W.H. Ip (2nd from left) and his research team



The IoT-based advanced automobile parking navigation platform



Essential devices of the IoT-based automobile parking navigation system



The project reaped a Gold Medal with the Congratulatory Certificate of the Jury and a special merit award at the 43rd International Exhibition of Inventions of Geneva.

at certain times in the registry programme, a user has the privilege to reserve a parking space in advance. That is a perk many customers would appreciate." In fact, the system can also be connected with environment sensors to monitor the conditions within the car park, such as temperature and carbon dioxide level. When they hit certain levels, the exhaust fan will be turned on to freshen and cool down the air. As you don't need to drive around for parking spaces, you also save fuel and spare the urban atmosphere some exhaust fumes. In case of any exceptional events inside the car park, smart sensors would send updates to the system to inform you. All in all, your parking experience has never been this great.

In April 2015, the IoT-based advanced automobile parking navigation system reaped a Gold Medal with the Congratulations of Jury and a special merit award at the 43rd International Exhibition of Inventions of Geneva, Switzerland. It also won the Big Data Analysis Award 2014 on Variety, a silver award in IoT Implementation Excellence and a silver award in IoT Application Innovation at the Hong Kong IoT Awards 2014.