Existing example of V2I (based on smartphone)

Intelligent Parking Information System (IPIS)

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Many cities, e.g. Beijing, Moscow, London, Vienna report problems due to poor parking. Worldwide average is 15min for parking search; worst case up to 30min. This has crippling effects on people’s time efficiency and the economy at large.

Financial Implications

**Direct financial losses for city halls:**
- inefficient parking place utilization

**Indirect financial losses for city halls:**
- less attractive to come downtown due to headache of finding parking
- many accidents due to drivers not concentrating
- massive pollution due to parking traffic with long-term health impact

**IPIS**

Provide information about the current parking situation to the end-user via mobile application and navigate the end user to the vacant parking lot.

**IPIS principles:**
- Parking lots vacancy detection
- Information gathering
- Sensors technology
- Navigation and positioning technology e.g. GPS
- Mobile technology.
- V2I (Infrastructure to vehicle technology)
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- SHOWS REAL INFORMATION 24 hours / 7 days.
- REDUCES non-payment.
- INCREASES the amount of tickets purchased.
- OPTIMIZES The use of human resources

- REDUCES THE FURTRATION allowing to save time, fuel and associated cost.
- REDUCES accidents

- REDUCES CO₂ EMISSIONS helping to improve the urban environment.
- DETECTS if a parked car has a special permit.
- Allows the development of PRICING STRATEGIES.

- SCALABLE, ROBUST AND RELIABLE.
The system in London is called SmartParking and is operated by Westminster Council. It has been started in 2012 when a trial was done with 189 sensors in 5 streets. The installation of the sensor network has been started in January 2014. More than 3000 RFID equipped infrared sensors were installed on parking bays to detect vehicles. In phase 2 further 7000 sensor will be installed on the network. A team of three workers is able to install sensors with a rate of 50 a day.

- The Westminster Council calculates with costs up to 889,395 pounds, which is approximately 1.1 million euros.
- The costs of the sensor including installation are estimated to 217 pounds.
- The project is founded from revenues raised through paid-for parking in Westminster.
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Technology

- The system uses infrared sensors equipped with RFID technology.
- Each sensor is a completely wireless, battery operated independent unit and the battery life is up to five years.
- Transmission is done by so called zones controllers which are installed on streetlights or on traffic signs beside the roads.
- The zone controllers are gathering the information from the sensors wirelessly and transmit the status consequently in real time.
- The data is transmitted via cellular network to central server.
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The signal from the sensor is permanently updated and received from zone controllers mounted on streetlights or traffic signs.

The received signal is transmitted via cellular network from the zone controllers to a central server. The server gathers all signal and status from parking bays.

If a vehicle occupies a parking slot it will be detected by the infrared sensor within the road surface.

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The app gives the drivers information about the vacancy of a parking slot in the driver’s vicinity. It navigates the driver to the next bay where he can park his car and provides also the opportunity to pay the parking fees directly online via the app.
The system employed, called Fastprk, is considered to be the largest smart parking project in the world.

The technology was first trialed in the winter of 2011/12 and has been commercially operational since November 2012. The installation was realized in four stages:

- The first stage: Took place in November 2012. 1,000 sensors were successfully installed in paying parking areas.
- The second stage: (May-June 2013) included the instrumentation of around 2,000 parking spaces in total.
- The third stage: (Dec 2013/Jan 2014) involved the installation of 12,000 parking sensors. With this deployment, Moscow's becomes the largest smart parking project in the world.
- The fourth stage: (Mid 2014) include more than 50,000 sensors.

- On the top of the platform there is an integrated control system provided by ITS
- Active displays also installed on Moscow's paid-parking streets.
- Fastprk has been adapted to serve the disabled (10% of the spots), emergency services, ambulances and police cars.
Technology

- The system uses sonar sensors equipped with a technology that provides magnetic detection.
- Fastprk is a wireless system, which means that it is scalable and paying for expensive cabling and installation is not required.
- The system contains few hardware components and software, which make it easy to install.
- The hardware contains:
  - Parking node on each parking spot (composed of sensor, radio, battery, and packaging)
  - Gateway guaranteeing Internet connectivity via cellular/Wifi/Ethernet
  - Relay node to help improve coverage of parking nodes to reach the gateway
  - Panels indicating to the drivers about the availability and direction of parking spots
- The informations are transmitted to the driver via an application in the cellphone.
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How does it work?

One single gateway covers an area of about 1km².

The gateway sends the information via the Internet to the database in real time.

The occupancy is instantly reported to users via apps and illuminated panels in the street.

When a car parks over the sensor, it is detected and the sensor relays that information wirelessly to the gateway.

THE SYSTEM RELIES OF EMBEDDED SENSORS IN EACH PARKING BAY IN THE STREET.

When connected to the payment method system, the authority can identify non-paying cars and with the use of a tablet app, parking wardens can work more effectively.

REPORTING
The central control can get real time analytics about parking bays occupancy per areas and times of the day.