

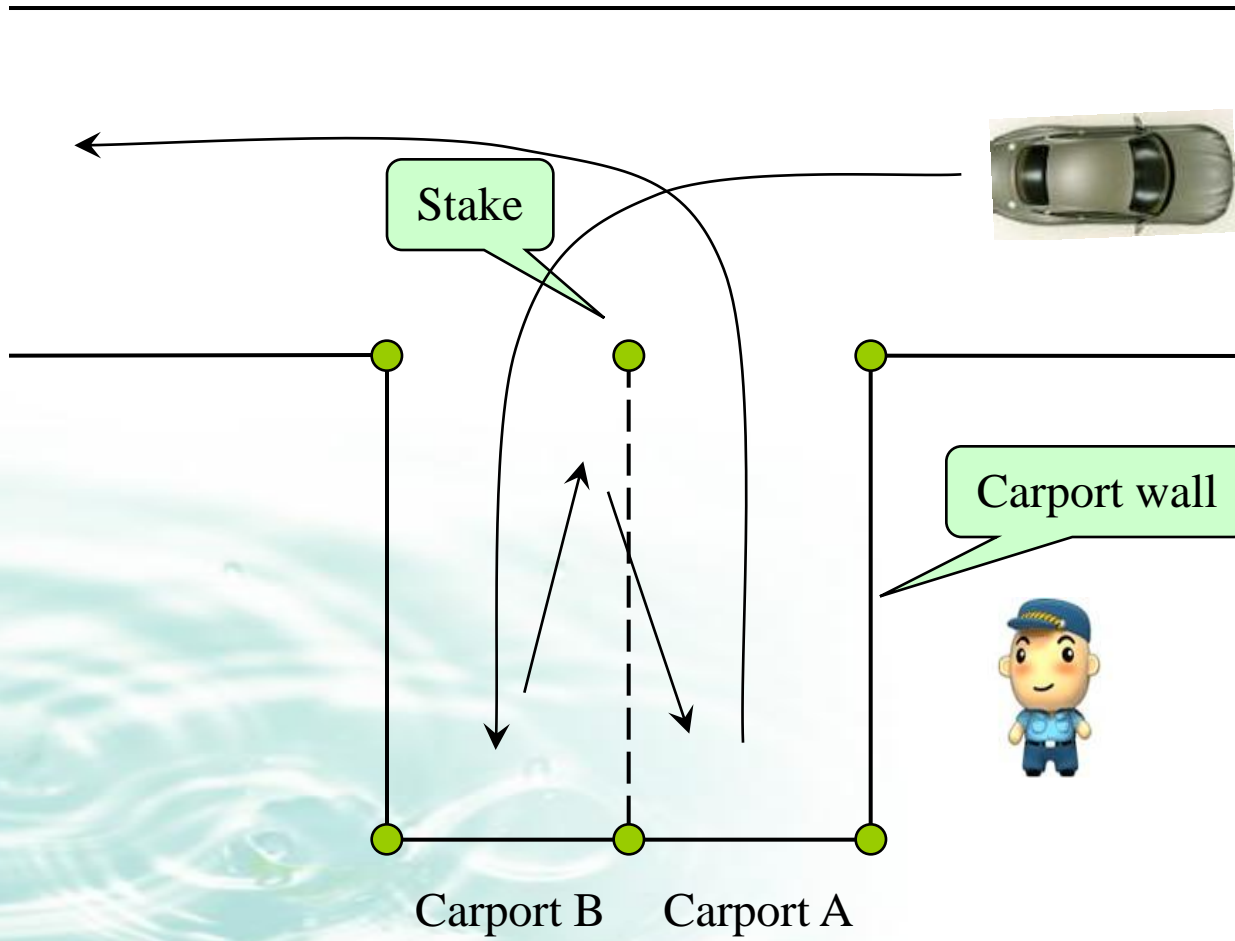
# WSNs Based Vehicle Stake Test System

Patent: ZL200720037901.3

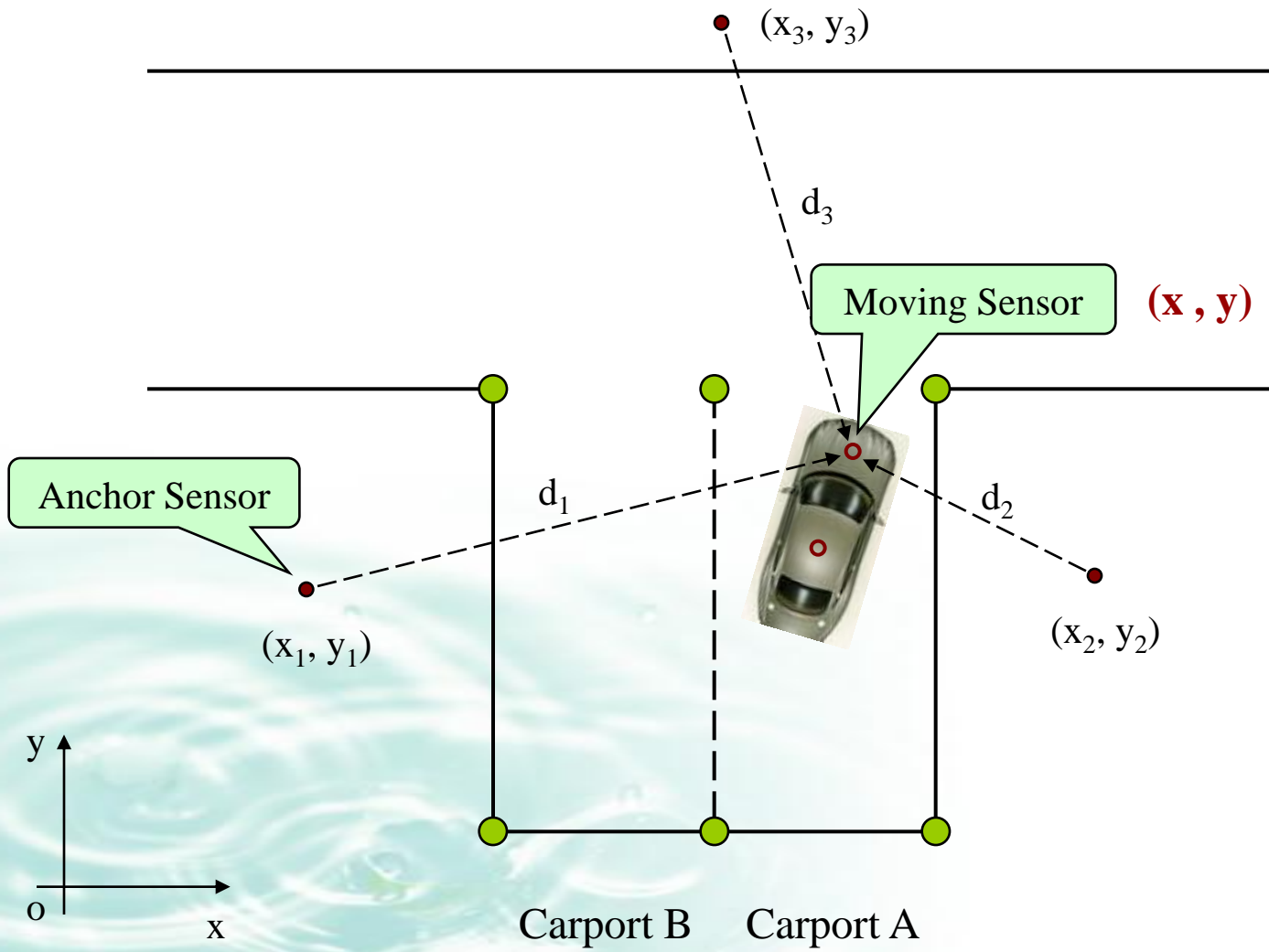
inventor: Na Xia

<http://www1.hfut.edu.cn/organ/jsjdsp>

# What is Vehicle Stake Test?

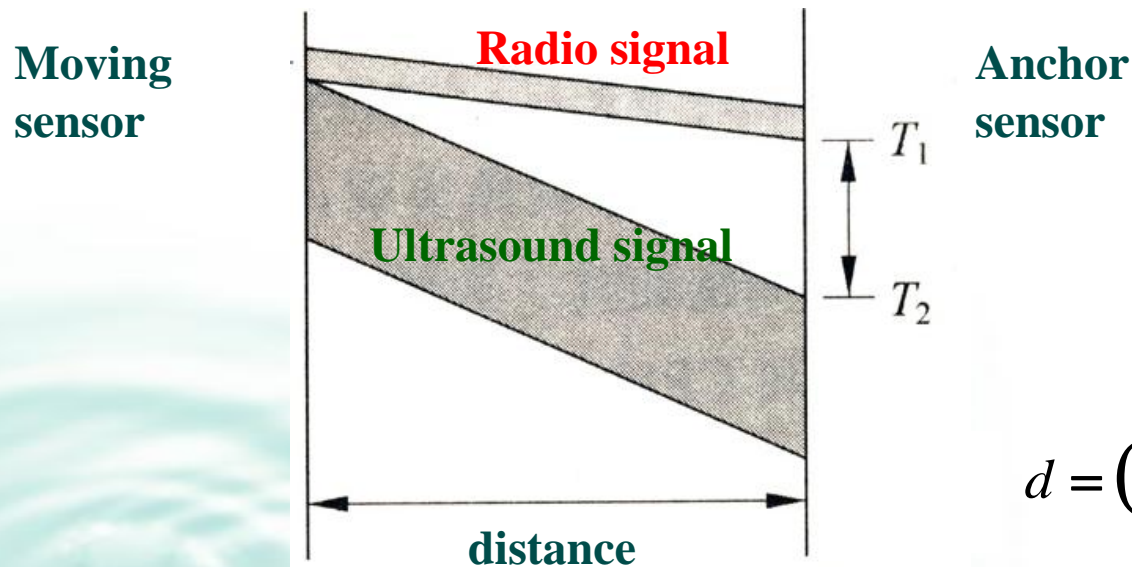


# WSNs Based Vehicle Stake Test System



# Key Technologies

- TDOA (Time Difference of Arrival)



$$d = (T_2 - T_1) \times \frac{C_1 C_2}{C_1 - C_2}$$
$$= (T_2 - T_1) \times C_2$$

# Key Technologies

- TDOA (Time Difference of Arrival)

four sets of experiment results (10meters area,)

$d$	1.2m	4m	6m	8m
$\tilde{d}$	$1.2 \pm 0.005$	$3.99 \pm 0.005$	$6.00 \pm 0.006$	$8.01 \pm 0.006$

The mean error is less than 0.6 centimeters.

# Key Technologies

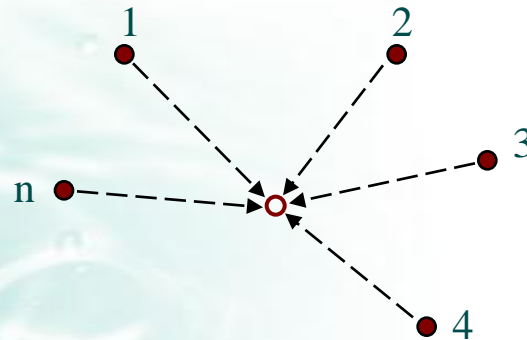
- More anchor sensors to improve the location precision

adding anchor sensors 1, 2, 3, ..., n;

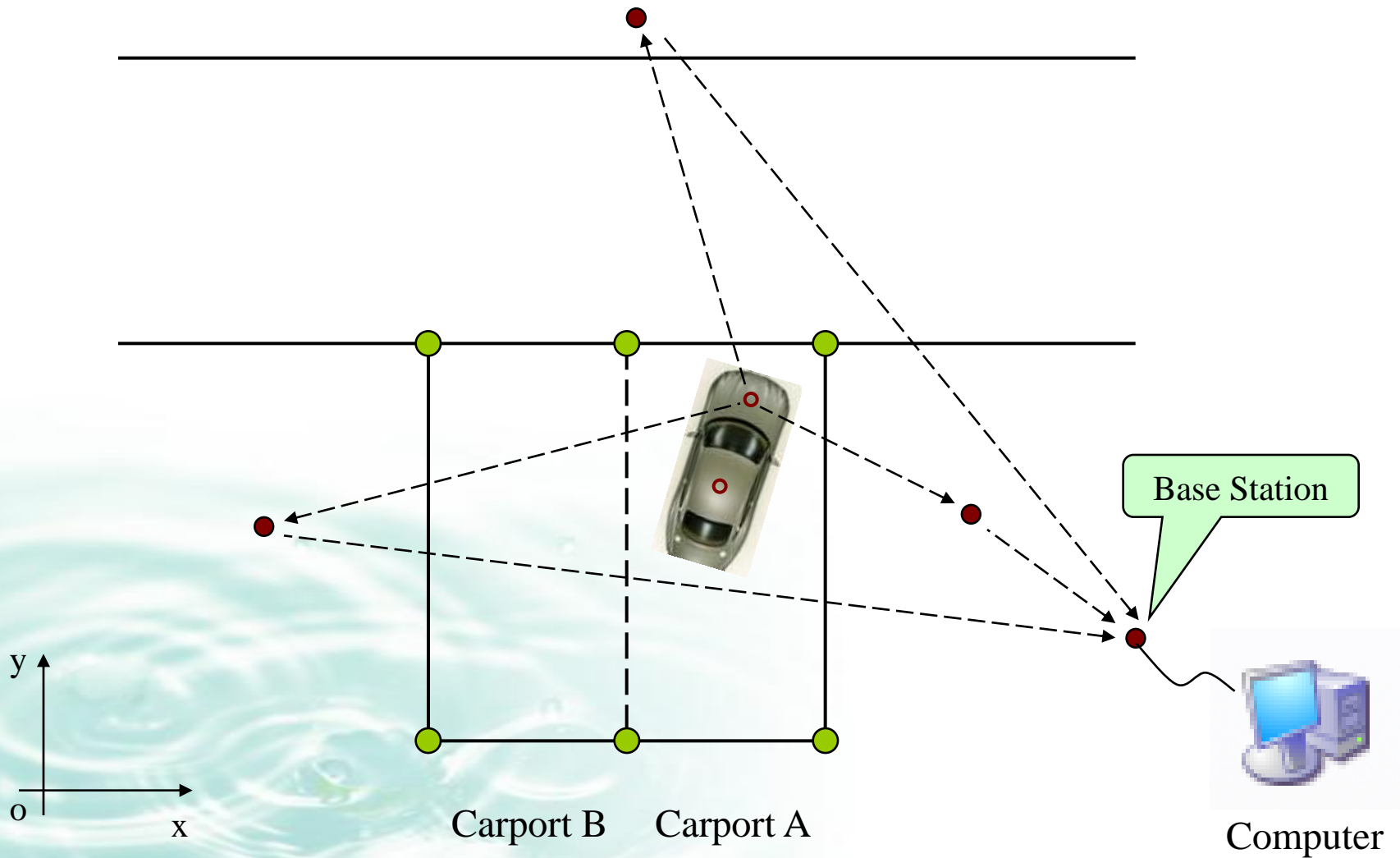
coordinate  $(x_1, y_1)$ ,  $(x_2, y_2)$ ,  $(x_3, y_3)$ , ...,  $(x_n, y_n)$ ;

the distances to moving sensor  $d_1$ ,  $d_2$ ,  $d_3$ , ...,  $d_n$

The calculated coordinate  $(x, y)$  can be more precise.



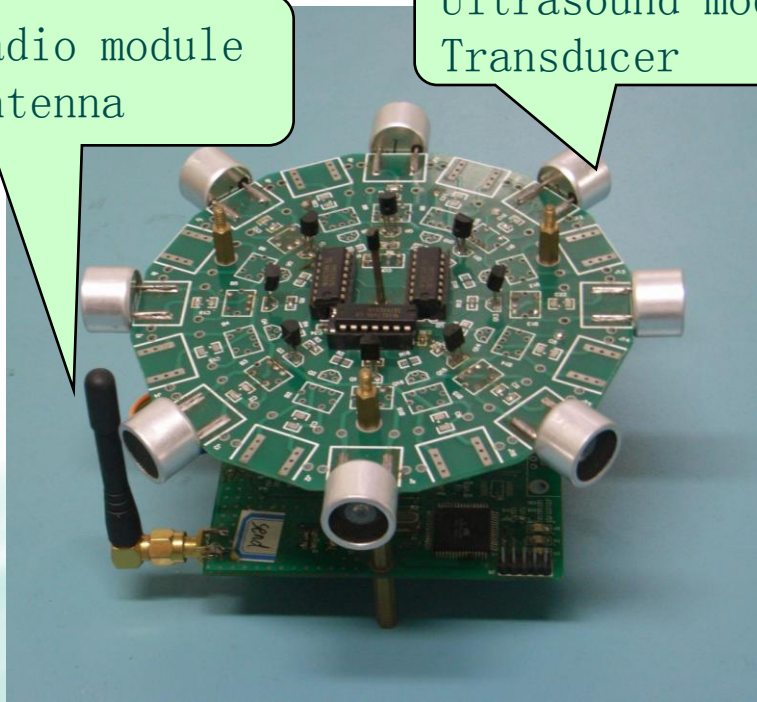
# System Architecture



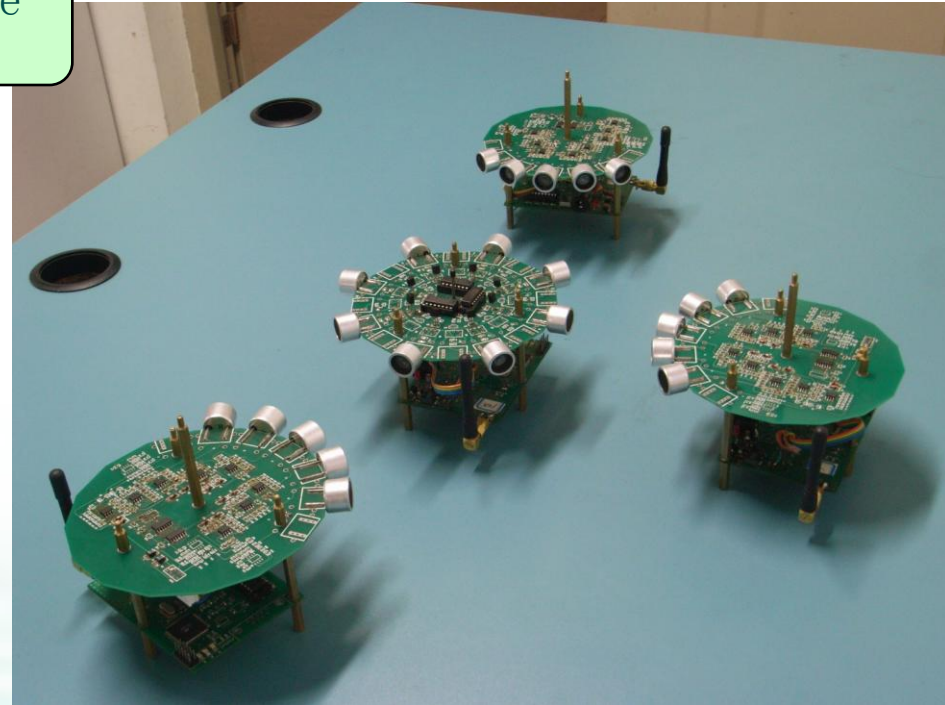
# Sensors

Radio module  
Antenna

Ultrasound module  
Transducer



Moving sensor



Moving sensor and Anchor sensors

# Show

- Demo



- Close shot



- Main devices

	Devices	Type/Performance	number
1	Wireless Sensors	Atmel mega128 single chip, CC1000 communication chip, SZW-S/R40-16P ultrasound transducer, RS-232 serial port or USB port	6
2	Computer	Commercial Computer, Intel P4, 2.6GHz, RAM 256MB, Hard disk 80GB, DVD-ROM, 17" Monitor	1
3	Stake Test Software for PC	Windows2000/NT OS, C/S and B/S Application Software Architecture	1
4	Printer	HP1012 Printer	1

- Main technical parameters

Detection error  $\leq 0.5\text{cm}$

Response delay  $\leq 0.2\text{s}$

Sensor Power  $\leq 8\text{mw}$

# Conclusion

## Advantages of the System:

- Using the Target location Technology in WSNs ;
- Sensors can be deployed freely, no cables;
- The track of the vehicle can be recorded;
- Devices are pretty cheap.

## State of the System:

- The System is a patent in China;
  - It is being tried in several Driving Training Schools;
  - Hope it to be a new generation product for Vehicle Stake Test.
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