Unified Traffic Control System for Railway and Road Vehicles Using Mobile Phone Line

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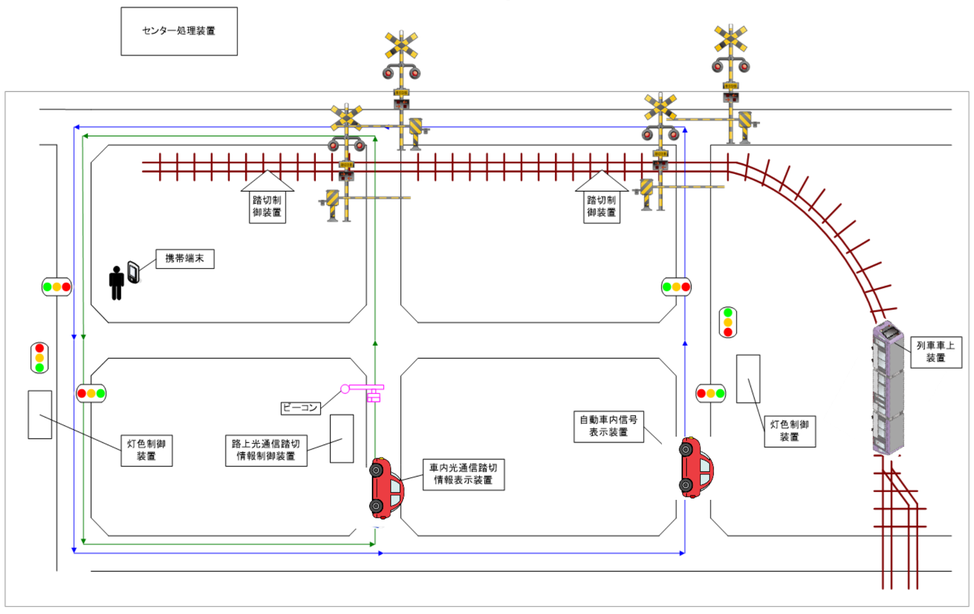
Objective

Unified traffic control system for railway and road vehicles using mobile phone line is proposed. The demonstration is carried out at ITS experimental field in Kashiwa campus, including the railway test track, the test road, and the railway crossings.

Proposed system

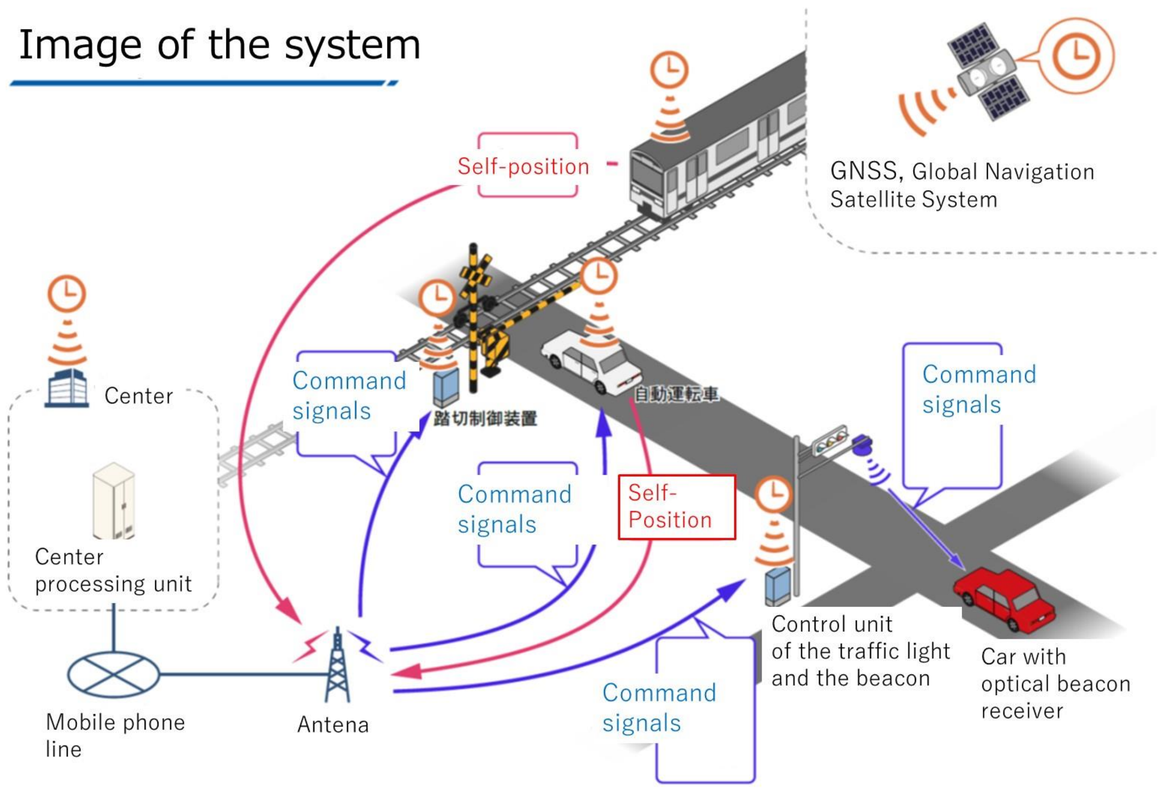
The onboard unit of the railway vehicle obtains the self-position with GNSS to transmit it to the ceter via mobile phone line. The center send the starting time to operate the crossing alarm and gate based on the estimated shortest time to reach the crossing. After the vehicle passes, the onboard unit send the signal to terminate the operation. As using the generic mobile phone line, the system can be extended to the unified traffic control, including traffic signal on road.

Overview of ITS experimental field.



Location of the experimental facilities.

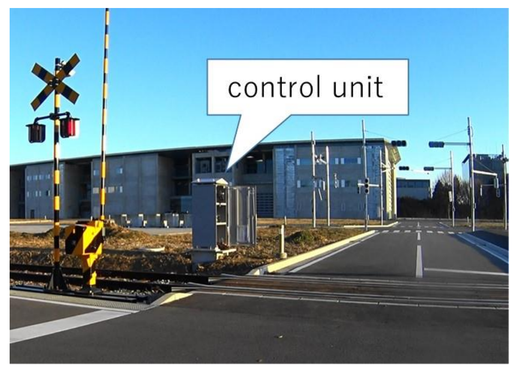
Image of the system



Experiments

The electric railway cart equipped with the onboard unit is utilized in the experiment. The alarm starts 20seconds before the arrival assuming the maximum speed is 9km/h, while the estimation of the starting time is updated every 5seconds. The center sends the signal to start the control to the road traffic lights, the car and the smartphone as well as the crossings. The correct operations including optical beacons to transmit the signal to the car were demonstrated.

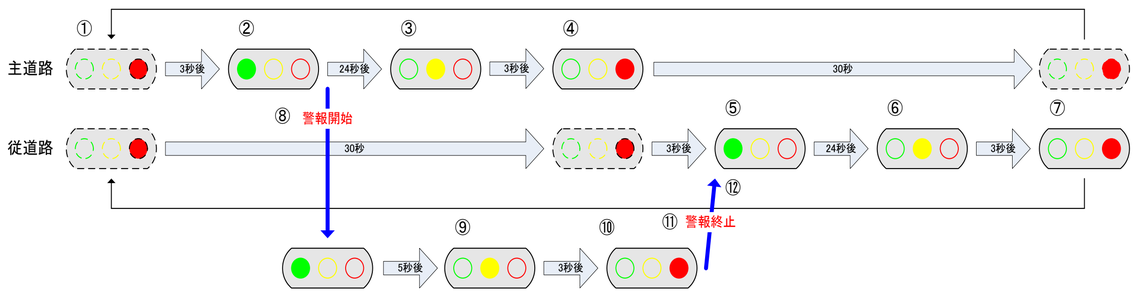
Electric railway cart



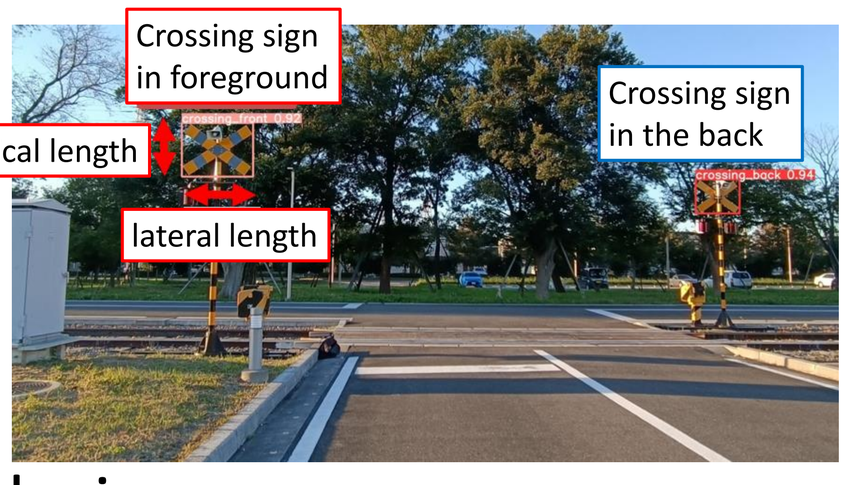
Control unit of the crossing

Level crossing assistance To assist to pass the level crossing not relying on infrastructure, the system detects crossing markers from images taken by an in-vehicle camera and detects the distance to the crossing mark based on the visibility. The system also detects the distance to the cross marker on the opposite side of the railroad, other vehicles, pedestrians, etc. The system to support the safe passage through railroad crossings is proposed and its performance is examined.

Unified traffic control system turns the traffic lights to all red when the railway vehicle approaches the crossing. The switching control has been demonstrated in the experiments.



Switching of the cycle of the traffic signals.



Conclusion

The system operated correctly to show the feasibility of the system.

Publications

Fukushima, N., Nakano, K., Yang, B., Wang, Z., Mei, X., Takata, T., Nagasawa, H., Automated vehicles passing level crossings, ITS Symposium, ITS Japan, 2023.

Nakano, K., Asano, A., Nagasawa, H., Takata, T., Kaizuka, T., Yang, B., Unified traffic control system for railway and road vehicles using mobile phone line, ITS Symposium, ITS Japan, 2019.