Automatic Train Control

Hoang Nga Nguyen

Department of Computer Science
Swansea University

October, 2011
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Introduction

- Automatic Train Control (ATC) reduces the involvement of human in the operation of trains.
- Aims: Improving safety, train services, reducing staff costs.
- Functions:
  - Automatic Train Protection (ATP)
  - Automatic Train Operation (ATO)
  - Automatic Train Supervision (ATS)
Historical systems

Great Western Railway “Automatic Train Control”
Historical systems

British Rail Automatic Warning System
Historical systems

Trainstop
Train Protection and Warning System

- **Aim:** reduce the number of *Signals Passed At Danger*
- **Functions:**
  - Speed Trap
  - Trainstop
Automatic Train Protection

- Aim: ensure the safe driving of trains at all times
- Implementation: trains carry a fail-safe computer ensuring that the train does not exceed a safe speed
- The computer needs to know a variety of data to calculate the safe speed, including: current train speed/distance, train length, train braking performance, maximum train speed, route data (gradient, maximum line speed).
Automatic Train Protection

Operation of ATP

- Calculate the maximum permitted speed
- Display to the driver
- Monitor the actual train speed against this:
  - if exceed by a certain tolerance (5km/h), then sound a warning, as long as the driver reacts
    - if the driver reacts, e.g. by reducing the speed, the warning will cease
    - if he fails to do so, the brake is applied automatically. The driver must but cannot release the brake until the speed reduces to the permitted level.
ATO and ATS

- ATO is an adaptation of ATP to allow train to drive itself
- Benefits: no need for a driver, acceleration and braking are smoother and more consistent, instant reaction to changing conditions, easy regulation of train service.
- Limitations: inabilities to recover from a complete failure of the system, to respond to unexpected obstruction on the line.
- ATS extends ATO to automate the signaller’s role
European Train Control System

Level 1
European Train Control System

Level 2
European Train Control System

Level 3
Historical automatic trains systems: GWR ATC, BR AWS, Trainstop.

ATC systems: ATP, ATO, ATS and ETCS.