GPS-Based Real-time Transport Control for Production Network Scheduling Simulation

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1. Problem Description

Nowadays production networks

- Players and connections
- Connections as logistic processes often bottlenecks with many interruptions
- Flow of materials not continuously visible
- Production control individually organized
- Much coordination effort

- Technical solutions necessary for controlling flow of materials in real-time and using tracking data for production scheduling
- Battery powered GPS-based track and trace system
Basic conditions of production networks

- Minimized stock
- Reduction of cycle-time
- Just-in-time supply

Networks demand for

- Reliable flow of information
- Safeguarding deliveries
- Tracking in real-time to estimate arrival times
- LSP independent tracking solution
2. Cargo Tracking in Production Networks

Potentials of a real-time GPS-based track and trace

- Estimated times of arrival
- Identifying interruption of transportation
- Real-time track and trace
- Operation time of transport
- Documentation of travelled routes
- Positioning and identification
Current methods and solutions for track and trace

- Discrete tracking
  - RFID
  - Barcoding

- Continuous tracking
  - Quasi-continuous tracking
  - Combination of continuous (vehicle) & discrete (shipment) tracking

- GPS
- GSM
3. Real-Time Transport Control

Basic conditions

- Defined tasks and flow of material through production network
- Pre-defined starting and operating times
  - Comparism of original and actual schedule
- Challenge:
  - Identifying of discrepancies from original schedule
  - Extend reaction time to avoid production interruptions

![Diagram showing production network]
3. Real-Time Transport Control

Algorithm draft

1. For every transport process do
2. Request of actual position of shipment/vehicle
3. Route planning from actual position to destination
4. Comparism of planned arrival time (starting time downstream process) and estimated time of arrival (result route planning step 2)
5. If estimated arrival time is equal or less than planned arrival time then
6. Next request
7. Else
8. Production Re-Scheduling
9. End If
10. End For
4. Integration of Transport Control in Production Planning

- 40 GPS modules with GPRS device for parallel shipment tracking and real-time transmitting of position data
- High performance antenna for receiving position data even inside trailers or containers
- High powered rechargeable battery for operating time of at least 72 h
4. Integration of Transport Control in Production Planning

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ild GPS.LAB
Characteristics of groupage freight production

- **Standard** conditions for routing process in a groupage freight depot
- **Discrepancies** of standard conditions (e.g. a delay in delivery) → Special actions of scheduling department
- Problem: **Identification** of any discrepancy
- The earlier a delay can be identified the longer is the reaction time
- Consequence: **Re-scheduling** of last-mile route planning (shipment takes another tour/ vehicle leaves the depot delayed)
- A cargo tracking could safeguard the identification of a delay
- Possible: Integration of information in the production planning algorithm
5. Testing Example Logistics Network

Last mile tour planning problem as path-dependent problem from main haul in logistics practice
5. Testing Example Logistics Network

New dynamic situation based on real-time transport control information
Conclusion

Process timeline with real-time transport control and application of dynamic production scheduling

Transportation Process

Delay in transportation process

Information of the delay

Re-Scheduling

Delayed departure, traffic jam, breakdown

Automatic and forwarder independent information about the delay integrated in production scheduling software

Enough reaction time so that a re-scheduling can be executed based on information

Production down-time can be avoided
6. Conclusion & Outlook

Outlook

- Increasing cooperation within production networks
- Tracking data access as input for manufacturing execution systems
- Development of a **structural model** for dynamic production scheduling based on GPS real-time information
- Integrating production control on supply chain level
- **Further applications** of GPS tracking systems with benefits for production networks
  - Mystery Shipping (audit approach)
  - Security of dangerous goods (safety approach)
  - Well-founded data base for future planning challenges (sustainable approach)
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Thank you for your kind attention!

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