An Integrated Simulation Model of Pedestrian Movements

The outline of the model and measurement systems

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Contents

Background
- Requirements of pedestrian behaviour models
- Research objective
- Research Design
- Methodologies
- Framework of the model
- project plan

Pedestrian-oriented planning

Lively town centres

of Pedestrian Movements

Kay Kitazawa

Background
- Urban planning
- Spatial marketing
- Location-based services

Background
- Urban planning
- Compact city
- Not-compact city

Pedestrian-oriented urban planning

✓ Safety
  - less crime, fewer traffic accidents

✓ Convenience
  - accessibility to transport, shops, services

✓ Amenity
  - comfortable walking environment

Needs for Pedestrian behaviour model

Actual movements

Necessary information

Influential factors

Spatial marketing

✓ Tenant strategy (leasing, fee)

✓ Improvement of floor plans

- signage system

Actual movements

Influential factors

Needs for Pedestrian behaviour model
Background

- Location-based services
  - Provide appropriate information according to user's location / needs
- Patterns of users' routes/activities
  - Necessary information - contacts
- Needs for Pedestrian behavior model

Requirements of pedestrian behavior models

- There are several needs to develop pedestrian behaviour models
- Key issues
  - Understand and explain real pedestrian’s movement
  - Represent dynamic interaction process between pedestrians and their environment
    (esp. Information which people obtain)

Current pedestrian behavior models

- Crowd dynamics
  - Micro scale behaviour (e.g. obstacle avoidance)
- Transport model
  - Network analysis and OD/route estimation
- Stochastic model
  - Probability of state-to-state transition

- Current needs for pedestrian behavior models

- Micro scale behaviour (e.g. obstacle avoidance)
- Transport model
  - Network analysis and OD/route estimation
- Stochastic model
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Crowd dynamics

- Micro scale behaviour
  - Obstacle avoidance
- Transport model
  - Network analysis and OD/route estimation
- Stochastic model
  - Probability of state-to-state transition

Transport model

- Shortest path between OD
  - Distance, speed ratio, condition of the road, etc.
- Gravity model
  - Probability of discrete choice
  - Calculate probability of state-to-state transition

Gravity model

- Probability of choices
  - Distance, condition of the road, etc.
To develop a new pedestrian behavior model

- Requirements of pedestrian behavior models

  - Crowd dynamics
    - Well represent large-scale walking
    - Enable them to go to and why
    - Well know what, why, who model
    - Geographical attributes
  - Transport model
    - Update for new option of transportation
    - Number of people who stop at the intersection
    - Probability of entering from one place to another
    - Probability of leaving the two intersections
    - Number of people who stop in each place
    - Number of people who stop in each place
  - Stochastic model
    - Useful for being limited on how people make plans
    - Speed and magnitude of probability
    - Useful for in small scale movement
    - Not explain why they choose certain place

- Research Aim and Objectives

  - To develop a new pedestrian behavior model
    - Be capable of explaining real pedestrian’s movement
      - Many factors should be considered on observed data
      - Can be validated with continuous measurement or monitoring
    - Represents dynamic interaction between pedestrians and their environment
      - In a way it includes the mental and environmental factors
      - Not only includes the mental and environmental factors
    - Can be used as a simulation model
      - To visualize
      - To enable the model easy to understand, wide knowledge
    - Be validated through comparison between actual trajectories
      - Can simulate different events such as pedestrian activity areas
Current positioning technologies:

- GPS-based technology
- Cell-based technology
- Image processing
- Autonomous positioning
- Laser scanning
- Ultra-sonic wave
- Traffic counter

Analysis on basic walking patterns:

- Analysis of walking patterns in the concourse:
  - Relationship between distance from main traffic flows and pedestrian movement density.

Survey on pedestrian movement in a railway station:

- Title: 2003/10/21 (Sat) 5:00 - 2003/10/22 (Sat) 25:00
- Route: A series of pedestrian movement surveys in a railway station.

Research plan:

- Survey of pedestrian movement in public spaces:
  - Walking patterns
  - Minimum times for pedestrian movement
  - Walking speed
  - Object detection

- Marketing research:
  - Survey of pedestrian movement in traffic flows
  - Analysis of pedestrian behavior in traffic flows
  - Minimum times for pedestrian movement

Implement simulation:
Ultra-sonic wave

3-D Active Be

AT&T Laboratories Cambridge

Gathering the range points of moving objects from all client computers, and integrating them into one coordinate system

Tracking process finished?

Foot

Points on one foot

Clustering: A foot candidate

Grouping: Two foot candidates as a step candidate

Seeds of new trajectories

case 1

case 2

Yes

No