

## Monitor systems in smart cities

- Monitor real-time city states
- Check the alignment between requirements and city states
- Support decision-making

## Challenges

- Significant language difference: English vs Formal Language
  - Damerau-Levenshtein distance: 67 > English-Latin
- Missing & inaccurate information
  - 27.6% missing proper locations

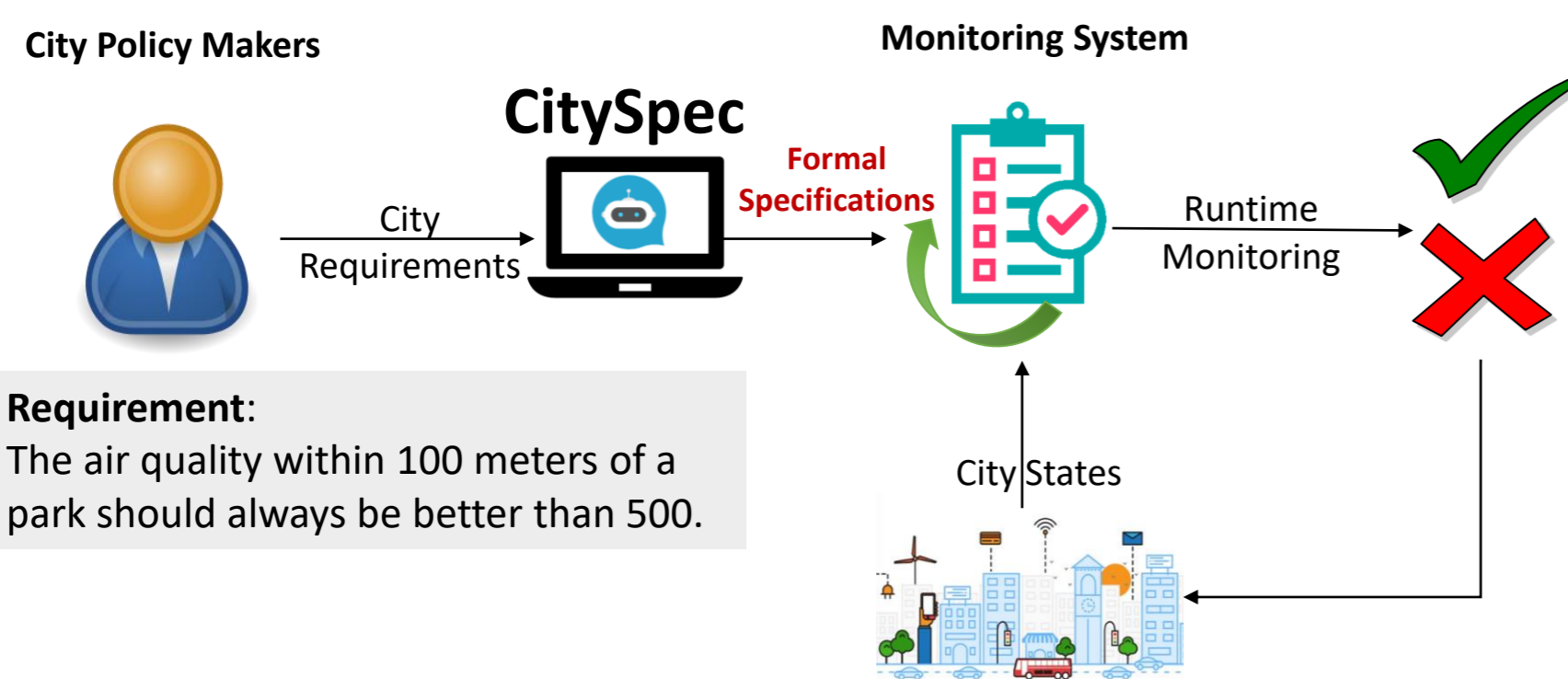


Fig.1 How CitySpec helps city policy makers work with monitoring systems

## Contributions

- Deploy CitySpec, the first intelligent system for requirement specification, using a **user-friendly** interface
- Implement a **translation model** to convert English requirements to formal specifications
- Apply novel **online learning** techniques to allow the system to learn continuously

## System Overview

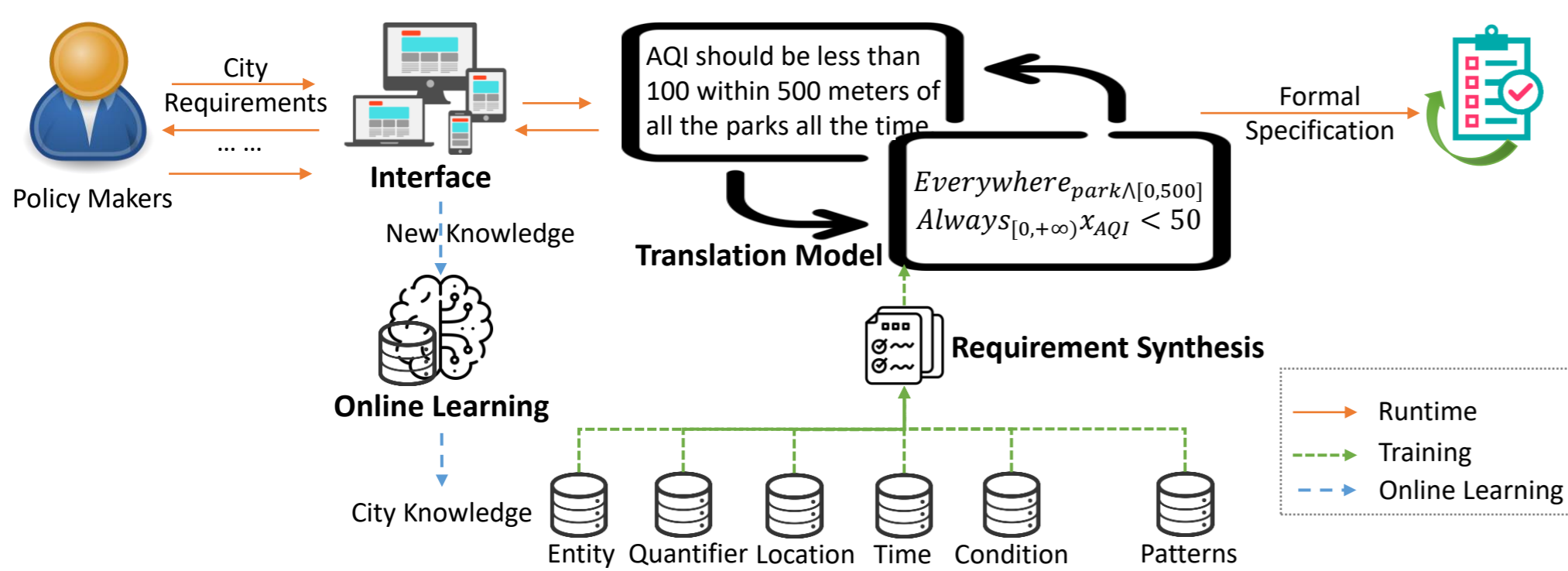


Fig.2 System design of CitySpec

### City Requirement Specification

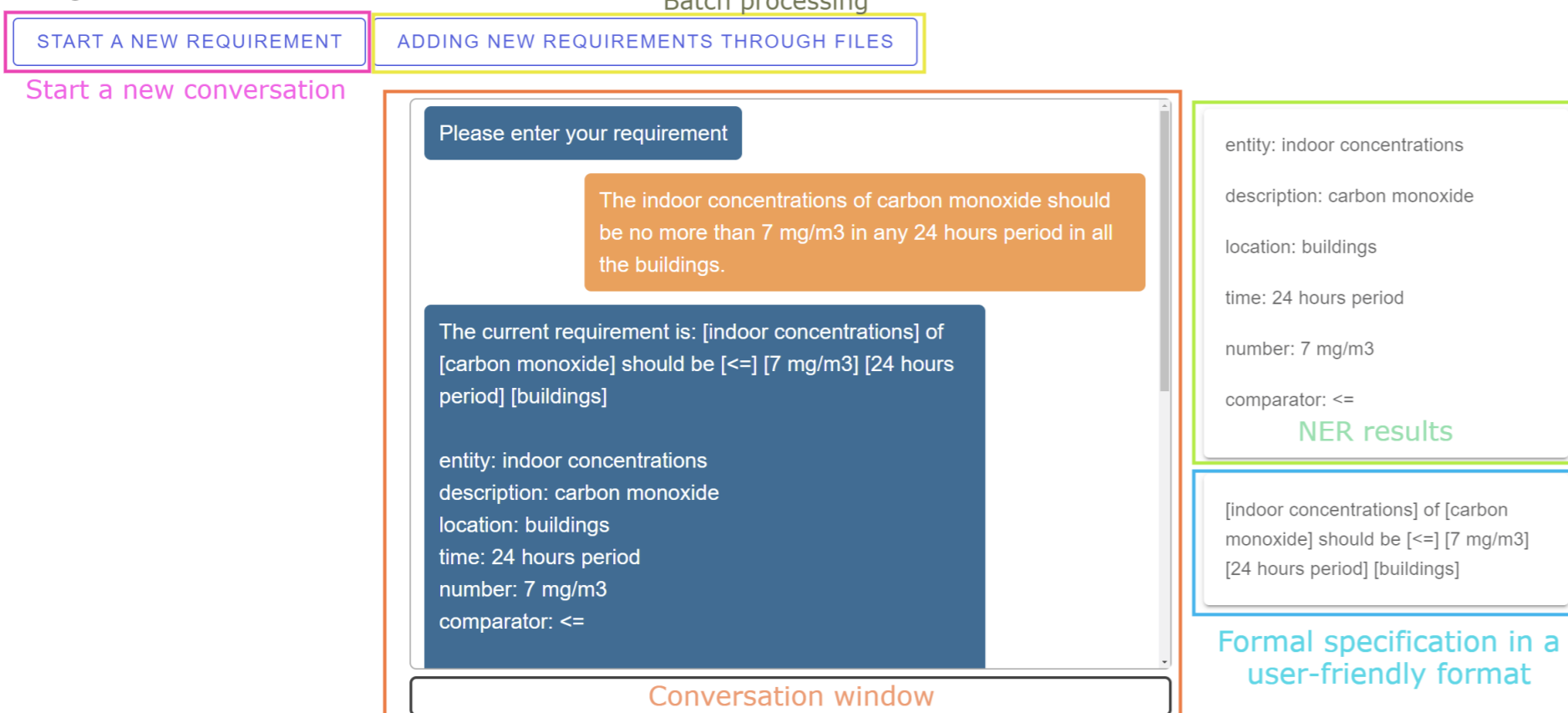


Fig.3 Web page design of CitySpec

### Key components:

- Conversation Interface
  - Interactive completion
  - Human-in-the-loop correction
- Translation Model
  - Conversion from English to Formal language
- Requirement Synthesis
  - Introduces more knowledge from limited data source
- Online Learning
  - A solution to learn continuously

## Demonstration of key features



Fig.4 Input one requirement without location information

### Interactive Completion

- Back-and-forth conversation-based interaction
- User confirmation is always needed before final report

### Human-in-the-loop Correction

- Detect, report, and correct requirements with user clarification

## Online Learning

- Short-term learning: **temporary** but **fast** reactions to unknown or unsure domains
- Long-term learning: **permanent** knowledge to memorize unknown or unsure domains after **validation**



Fig.5 The ability to memorized user clarification when similar situation occurs

## Insights & Future work

- CitySpec bridges the gap between city policy makers and the monitoring systems.
- CitySpec can support policy makers **accurately writing and refining** their requirements.
- Online Learning grants CitySpec the ability to learn **effectively and continuously**
- Future development: Ongoing collaboration with **Nashville** and **Newark** city offices

### Contact

Name: Zirong Chen  
Email: [zirong.chen@vanderbilt.edu](mailto:zirong.chen@vanderbilt.edu)