

### Motivation

Djnn improve the design process of highly innovative interactive human-machine systems.

#### SUPPORT user centric design process

- Concurrent engineering (human factor specialist, visual designer, interaction designer and software programmer)
- Fast prototyping for early evaluation and eased specification
- Iterative process
- Ease graphical integration

#### REDUCE development cost

- Multi-platform
- Multi-language
- Reuse of parts of the prototype for the development

#### BRING innovation and interactivity

- Adaptive
- Create new component and interactions rather than assemble existing one
- Multimodal

#### Project goal:

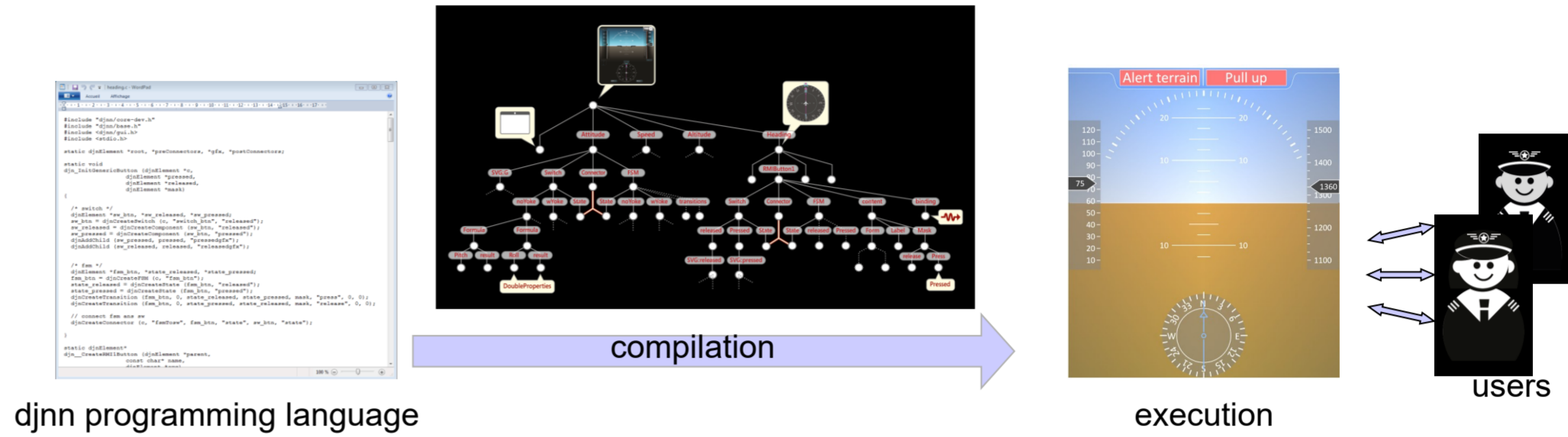
Prove that **formal verification** for human-machine systems can be performed with djnn framework.

The best used method for the verification of human-machine systems relies on performing several cycles of (prototyping X evaluation by the end-users). This method is costly and not always efficient. Our goal consists in studying how some other verification methods – in particular formal methods - can be used. We base our approach on djnn framework.

### Description

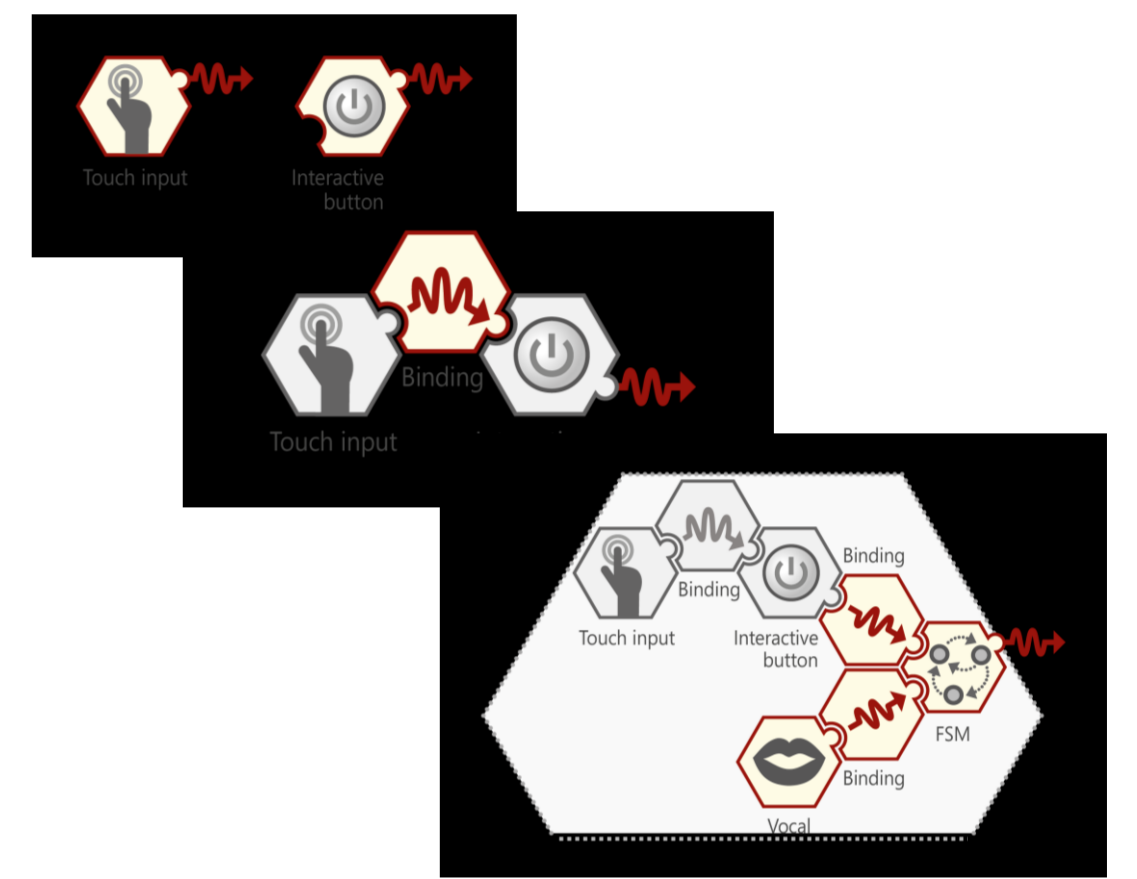
The **djnn framework** is a hierarchical event-driven component system with a unified set of underlying theoretical concepts focused on interaction. Djnn supports combinations of interaction modalities and user centric design processes.

#### Djnn is a fractal collection of interactive components



#### Events are the ONLY execution mechanism

- The execution of a program is described by the interactions between its components. Components react to events detected in their environment, and may themselves trigger events. This is called “**activation**”.
- Creating a **coupling** between component A and component B ensures that the activation of A will trigger the activation of B. **Control structures** are components that create couplings. Other components store data, represent output modalities, or serve as event sources.
- Designing **interaction styles** amounts to creating component patterns (e.g. building a multimodal component for retail application).

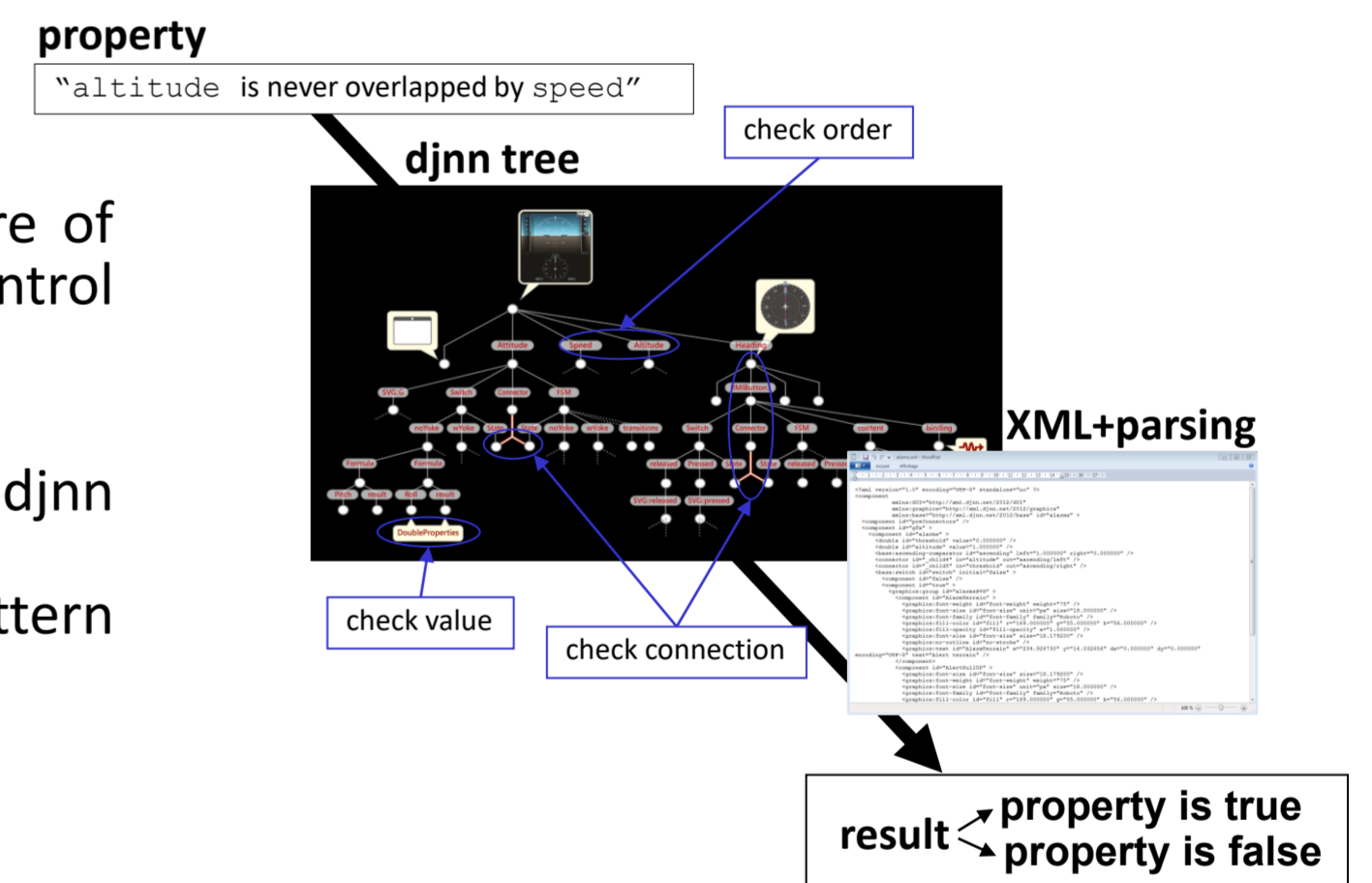


### Results

#### Introduction of formal verification capabilities for human-machine systems

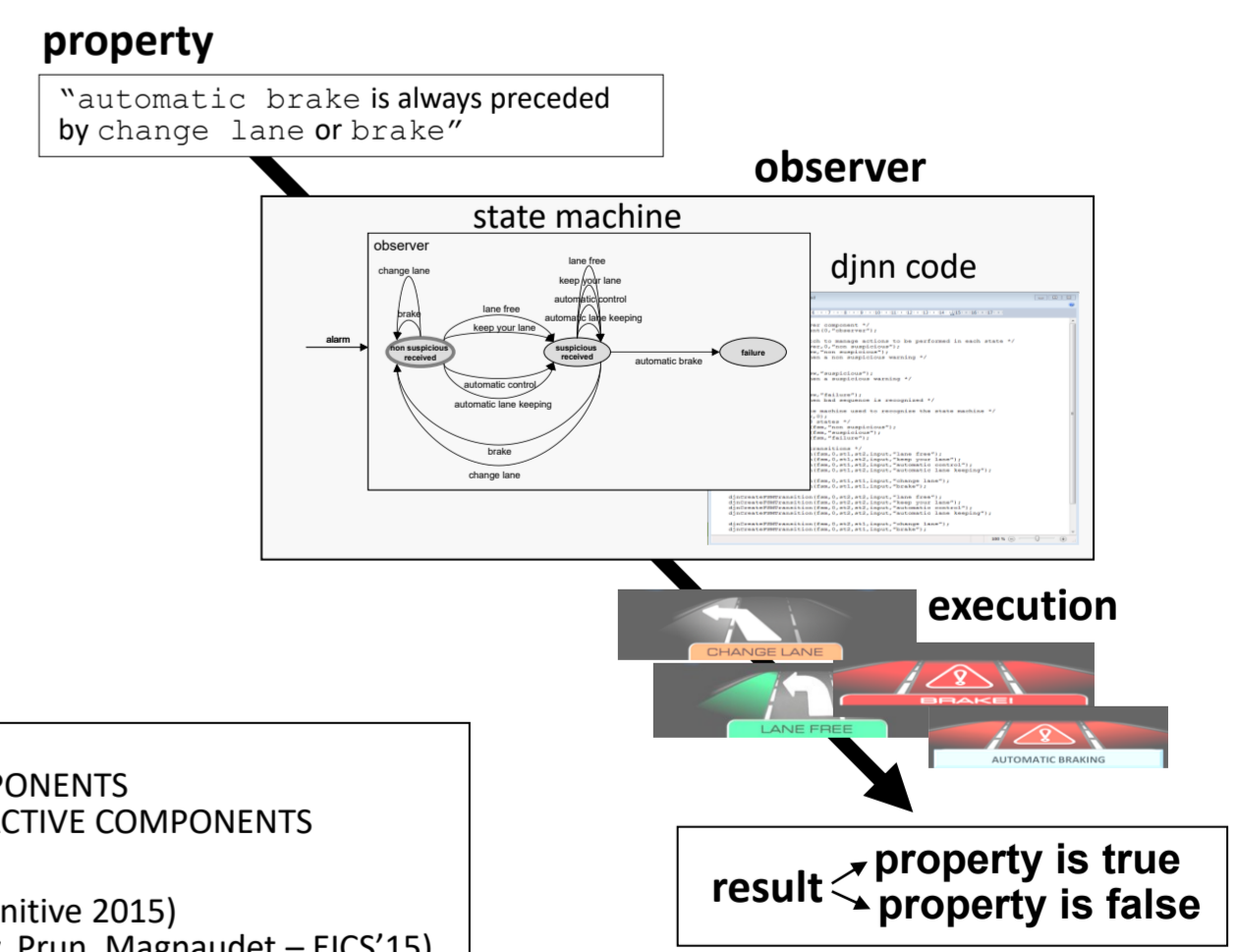
##### Abstract interpretation:

- **Idea:** exploit the singularities of djnn tree. Djnn tree contains various information: structure of components (graphic, control, ...), data flow, control flow, order relation.
- **Method:**
  - Djnn tree is dumped in XML format from djnn code.
  - Use static analysis of the XML tree: pattern matching with XPATH tool.



##### Synchronous observers:

- **Idea:** At runtime, observe a complex sequence of internal events described by a regular expression.
- **Method:**
  - Use a djnn state machine component to model the property to be observed.
  - Warn when the property is broken.



**2 patents**  
 - EP 69805: A PROCESSING UNIT, SOFTWARE AND METHOD FOR CONTROLLING INTERACTIVE COMPONENTS  
 - EP 69806: A METHOD, SOFTWARE AND PROCESSING UNIT FOR VERIFYING PROPERTIES OF INTERACTIVE COMPONENTS  
**3 publications in international conferences**  
 - Towards Support for Verification of Adaptive Systems with Djnn (Prun, Magnaudet, Chatty – Cognitive 2015)  
 - Automated verification of properties of interactive components from their executable code (Chatty, Prun, Magnaudet – EICS'15)  
 - Designing, developing and verifying interactive components iteratively with djnn (Chatty, Magnaudet, Prun – ERTS'15)  
**Integrated into V-HCD (Virtual Human Centred Design) platform** based on RT-Maps with Pro-SIVIC®, COSMODRIVE and MOVIDA tools.

### Contact Information

Djnn is an ongoing research project, already available for public download at <http://djnn.net> and aimed to be released as an open source project.

**For all information:**  
[contact@djnn.net](mailto:contact@djnn.net)

### Methods, Techniques, Tools

This is a ...	<input type="checkbox"/> Method	<input type="checkbox"/> Technique	<input checked="" type="checkbox"/> Tool
Method			
Technique			
Tool	djnn		

### Consortium



### Acknowledgments

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