Attentional Trees And Robotics: Towards an Executive Framework Meeting High-level Decision Making and Control Layer Features.

Pilar de la Cruz[1] and Matteo Saveriano[2]

***Abstract*— This electronic document is a live template. The various components of your paper [title, text, heads, etc.] are already defined on the style sheet, as illustrated by the portions given in this document.**

I. INTRODUCTION

This template provides authors with most of the formatting specifications needed for preparing electronic versions of their papers. All standard paper components have been specified for three reasons: (1) ease of use when formatting individual papers, (2) automatic compliance to electronic requirements that facilitate the concurrent or later production of electronic products, and (3) conformity of style throughout a conference proceedings. Margins, column widths, line spacing, and type styles are built-in; examples of the type styles are provided throughout this document and are identified in italic type, within parentheses, following the example. Some components, such as multi-leveled equations, graphics, and tables are not prescribed, although the various table text styles are provided. The formatter will need to create these components, incorporating the applicable criteria that follow.

II. RELATED WORKS

A. Logic fixed Techniques

First, confirm that you have the correct template for your paper size. This template has been tailored for output on the US-letter paper size. It may be used for A4 paper size if the paper size setting is suitably modified.

B. Attentional techniques

The template is used to format your paper and style the text. All margins, column widths, line spaces, and text fonts are prescribed; please do not alter them. You may note peculiarities. For example, the head margin in this template measures proportionately more than is customary. This measurement and others are deliberate, using specifications that anticipate your paper as one part of the entire proceedings, and not as an independent document. Please do not revise any of the current designations

III. SYSTEM OVERVIEW

Attentional Trees framework aims at integrating the following features:

1) Task planner based on Behavior Trees
2) Priority handling of tasks based on attentional mechanisms and emphasis [**?**]
3) JSON schema conversion into Behavior Trees

A. Task Planning

B. Priority Handling

1) Attentional Mechanism:

2) Emphasis:

C. JSON Schema

A typical JSON schema consists of a list of string objects. The first object element defines the root of the Behavior Tree. The remaining object elements are defined as subtrees and will be added recursively as children from the root. Each object contains properties `name`, `type`, `father`, `children` and `parameters`, which provide with information about the Behavior Tree node types as well as additional attributes for pre-and post-conditioning handling, priority execution and any additional information.

```
{
    "name":"selector01",
    "type":"selector",
    "father": "sequence01",
    "children": ["isReached","reach"],
    "parameters": [["emphasis", 1]]
}
```

IV. METHOD

A. Behavior Trees Overview

1) Formulation of Behavior Trees: A Behavior Tree (BT) is defined as a way to structure the switching between different tasks in an autonomous agent [1]. Motivated by the limitations of Finite State Machines[1], it provides with an ability to quickly and efficiently react to changes as well as the required modularity in systems where components may be interchangable and/or extendable.
Behavior Trees can be divided into two type of nodes: control flow nodes and execution nodes. Control flow nodes may be of type Sequence, Fallback/Selector, Decorators or Parallel. Similarly, execution nodes may be either conditions or actions. Symbols for each node are defined in Figures .... respectively.

[1]"one-way control are aninvitation to make a mess of ones program - Dijkstra [2]

2) Execution of Behavior Trees: A Behavior Tree is executed from its root node by spreading *ticks* with a given frequency from the root throughout all its children. Children will be only executed if they receive ticks and may respond with either return status *Running*, *Success* or *Failure*. The way each type of node respond to ticks is described in Table I.

Node Type	*Success*	*Failure*	*Running*
Fallback/ Selector	If one child succeeds	If all children fail	If one child returns Running
Sequence	If all children succeed	If one child fails	If one child returns Running
Parallel	If >M children succeed	If >N-M childrne fail	else
Action	Upon completion	If impossible to complete	During execution
Condition	if True	if False	Never
Decorator	Custom	Custom	Custom

TABLE I

TYPES OF BT NODES AND THEIR RETURN STATUS

The Sequence node executes its children sequentially. The traversal starts from the first child and proceeds to the following until a child returns either running or failure status.

- The Fallback or Selector node executes its children sequentially until one succeeds. This node the will execute unless one child succeeds, in which case the Selector ends with return status *Success*.
- The Parallel node will traverse all its children in a single step, allowing more than one of its children to be running at the same time.
- The condition node is ideal for using simple predicates in the Behavior Tree. The condition node will return either *Success* or *Failure* in case the predicate is True or False respectively. The need of adding precondition during planning (See Section IV-B) will motivate the use of these type of nodes during implementation.
- The action node triggers an ayschronous execution while *Running*. It will remain with status Running until the action is ended, at this point its status turns to *Success*. In case during tick tree traversal an action node is not traversed, the execution will be cancelled and return status will turn to *Failure*

Figures provide graphical representations of typical Trees formed by Sequence, Fallback/Selector and Parallel Nodes respectively.

B. Emphasis and Planning

Inspired by [6], Emphasis accounts for adding the required bottom-up regulations in the Behavior Tree to support planning and keep a goal-oriented task execution approach. This way, actions will be "emphasized" depending on environment variables(object detected, distance from agent to object, thresholds, etc). Refer to Section V for more details.

-Description JSON emphasis info-
The Planning approach is an extension of the backchaining method (PA-BT) described in [**?**]. It consists of replacing a condition by a small Behavior Tree achieving that same condition. Actions are then carried out in order to reach a specific goal which is defined at top of the tree. Action retrieval is done dynamically by loading the corresponding json schema. JSON provides not only a definition of the actions but also the way the tree should be extended. Followed by an emphasized ...

Algorithm illustrates this process
–Algorithm goes here—

C. Blackboard Mechanism

D. Implementation Details

V. EVALUATION

A. Use Cases

VI. CONCLUSIONS

A conclusion section is not required. Although a conclusion may review the main points of the paper, do not replicate the abstract as the conclusion. A conclusion might elaborate on the importance of the work or suggest applications and extensions.

APPENDIX

Appendixes should appear before the acknowledgment.

ACKNOWLEDGMENT

The preferred spelling of the word acknowledgment in America is without an e after the g. Avoid the stilted expression, One of us (R. B. G.) thanks . . . Instead, try R. B. G. thanks. Put sponsor acknowledgments in the unnumbered footnote on the first page.

References are important to the reader; therefore, each citation must be complete and correct. If at all possible, references should be commonly available publications.

REFERENCES

[1] Michele Colledanchise and Petter Ogren. Behavior Trees in Robotics and AI. An Introduction. arXiv:1709.00084v3 [cs.RO] 15 Jan 2018.
[2] Edsger W. Dijkstra. Letters to the editor: go to statement considered harmful. Commun. ACM, 11:147148, March 1968.
[3] Malik Ghallab, Dana Nau, and Paolo Traverso. The actors view of automated planning and acting: A position paper. Artif. Intell., 208:117, March 2014.
[4] Caelan Reed Garrett, Tomas Lozano-P erez, and Leslie Pack Kaelbling. Backward-forward search for manipulation planning. In Intelligent Robots and Systems (IROS), 2015 IEEE/RSJ International Conference on, pages 63666373. IEEE, 2015.
[5] Leslie Pack Kaelbling and Tomas Lozano-P erez. Hierarchical task and motion planning in the now. In Robotics and Automation (ICRA), 2011 IEEE International Conference on, pages 14701477. IEEE, 2011.
[6] Matteo's framework