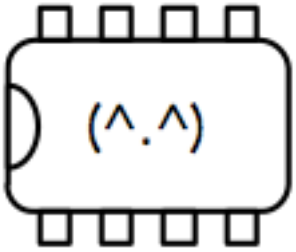
ZenAI Community of Robots ch1



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The purpose of this experiment is to create a small community of robots the interact with each other in hopefully interesting ways. In some sense it's related to my 'likesies' game idea, which was somewhat inspired by Chris Crawford's Gossip game.

I had puttered with this idea off and on, usually tinkering with 3d wibbles as the robots, but never getting satisfying results. Recently I read https://hackaday.io/project/2160-a-society-of-things which re-kindled my interest.

This document is a preliminary design exploration.

References:

- musing.somatic.rtf for my early thoughts on somatic state
- wibble.combined.111212.rtf for ideas on interactions
- _robimoti.rtf 01/05/14 for related notes
- app.ideas.from.blinky.rtf for notes on likesies concept
- https://hackaday.io/project/2160-a-society-of-things
- Article on "Emergence of Grounded Compositional Language in Multi-Agent Populations"

Overview

I enjoy building robots and trying to make them as small as possible. This tends to result in a lot of simplifications, so that in the end the robots don't really have much purpose other than to just exist, or to prove out some sensor or actuator. I mean, maybe they count as some sort of kinetic circuit sculpture or something. But in the end they really don't do much of anything. So I want to build some robots that actually do something, even if it isn't terribly useful.

So here is a simplified list of the things I want the robots to be able to do:

- Each has an RGB LED and glows a unique color.
- Each robot has the ability to sense the colored LEDs of the other robots.
- Robots can look for any other robot, or for a specific robot.
- Robots can face towards or away from other robots.
- Robots can move towards or away from other robots.
- Robots can send messages to other robots.

Every robot stores a database of information about all of the other robots. This includes at least:

- amity - perceived affection

- trust - perceived trust
- clout - perception of esteem

At the dawn of time the robots' databases are blank, and none of them thinks anything about any of the others. As they locate each other and engage in dialog they begin to build up their perception of the relationships between themselves and other robots.

Robots may ask other robots for information about themselves, or for information about another robot.

Robots may also give information about themselves or other robots to other robots.

For example:

- Blue: Hi Pink, I think <thought> about Orange.
- Pink: Good to know.
- Blue: Hi Pink, what do you think about Orange.
- Pink: I think <thought> about Orange.
- Pink: Hi Blue, what does Orange think about Red?
- Blue: I am not going to tell you. (Or Blue might lie.)

In the simplest form, each message is formed by:

- speaker - who the message is from
- listener - who the message is to
- subject - who the message is about
- verb - the action of the message
- object - the object of the message
- perception - the perception of object to subject

Examples:

speaker	**listener**	**subject**	**verb**	**object**
red	blue	red	tell	blue

red tells blue what red thinks about blue

speaker	**listener**	**subject**	**verb**	**object**
red	blue	pink	tell	blue

red tells blue what pink thinks about blue

speaker	**listener**	**subject**	**verb**	**object**

red	blue	pink	ask	red

red asks blue what pink thinks about red

Note, however, that the listener who is asked for information may choose to be truthful, to lie, or to refuse to answer. The response depends on how the listener feels about the speaker, the subject, and the object.

Planning

This is a somewhat ambitious project involving a number of related components. I need some type of simulation on a workstation to get the basic operation of the robot ai's working, and multiple physical robots. I need the algorithms governing the robots' feelings about each other, as well as for deciding what communications acts to engage in. And I need algorithms for locating other robots turning and moving into position to talk to, or ignore, other robots.

That much is already non-trivial. But on top of that I need physical/electronic mechanisms to locate other robots, navigate with respect to other robots and the environment, and to communicate amongst robots.

Broadly speaking, I need some sort of simulation, possibly involving a simple gui, numerous algorithms, sensors and actuators and firmware to drive them, and some form of simple but reliable enough wireless communications medium.

Sensors/Actuators

With respect to actuators, aside from motors to drive around, I need something to uniquely identify each robot to the other robots, in such a manner as to allow them to locate its position relative to their own. Of course, I want this to be small and simple, so things like cameras or directional WiGig beacons are not under consideration at this stage. RFiD isn't really directional. In fact, most of the simple OOK style radios aren't really directional enough as far as I can tell. So that leaves me with audio, or light. (Unless I can find a cheap, simple, camera.)

Communications

I have built several boards with IrDA modulators on the UART and have gotten them to communicate at distances up to about 6 feet at 9600 baud. So I know that this works.

But, the IrDA transceivers I am using are fairly directional, particularly at longer range. I am not sure yet whether this is an advantage, or a disadvantage.

A directional link will be harder to get lined up for reliable communications, though it should be less subject to noise from other conversations. But it makes it much more difficult to have an omni directional base station that can record the traffic, and send commands, for the entire community. Not that LED communications would be any more omidirectional.

Open Questions:

If there is no omnidirectional link then can the robots store enough sent/received messages with timestamps to be enable uploading and merging into a coherent log? Because I am not likely to be able to debug this very well without observing the coms.

Can I simplify com debugging by putting the robots all in a circle where they can all see

'hear' each other, and keep them stationary? Does that add value?

Can the robots locate and aim at each other well enough to get a line of sight for the I/R link? If so can they do this while both robots are moving? Or do they have to stop to talk to each other?

How can I intercept and record all communications traffic for debugging purposes if the links are directional?

What is the angle of the TFBS4711? The angle of half intensity is +/- 24 degrees. So it's only got about a 50 degree cone. So, yeah, pretty directional. More experiments needed.

Is it madness to put a base station on a servo turret and try to see, aim at, and talk to robots? That is starting to sound even more ridiculously overcomplicated.

Should I use a simple CIR demodulator and an I/R LED to try to get better omni?

Is it time to go to RF? I have some OOK radios waiting to be hacked into a project...

Is there another, simpler option, I am overlooking, like possibly audio? Hmmm...

Maybe the link is IR, it's directional, and one of the citizens is the sedentary mother. Then the bots seek out that node to upload their conversations. I.e., they go to the priest and confess?

Maybe the bots have an I2C flash to log their comms into so it doesn't overflow. They could also store data and images for their LCDs there.

Algorithms

Open questions:

- choose action
- choose confidant
- choose subject
- choose object
- control amity/trust/clout see gossip
- when to lie and by how much?
- and so much more...

Simulation

Open questions:

Currently trying to decide if there is a need for a gui representation of the robots, or if they are just processes. But, if they are just processes or threads, how do they locate, face, approach each other? Should I simulate all that as vectors and just not show it? Or do I need a gui of some type with little robots moving around?

End