Lighting the way to Mobile Phones as Robot Brains

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1 - Revisiting the Abstract 2 months later ..

The Abstract:
http://www.tertiaryictconference.co.nz/john-calder.html

"Let's use phones as Robot brains!"
YES - First trials work well.

"..gaining new insights .. by taking an unconventional approach"
YES - eg Rather than thinking Analogue vs Digital, think unexpected effective combinations.

.. involving a microcontroller is complex and expensive ...
NO - cost is as little as $3 (three dollars)
- and - experience - following the instructions it works first time
- and - microcontrollers can interface well with light patches.

Explaining "light patches" aka "screen opto-couplers":
(Youtube Video)
https://www.youtube.com/watch?v=dGFSwtsQrS8

Question for the audience.

We had chocolate fish prizes for audience participation … but what other piece of kiwiana features in this presentation?

(Answer is near the end of this document)

2 - Main result so far: Software "XMRemoteRobot"

Open Source Software Package published on GitHub.

https://github.com/manukautech/XMRemoteRobot

Our Scenarios need distant remote control over the public internet.

Latest version, 10 Sep 2017, is a multi-channel version to make a public demo possible.

It is also updated to the new ASP.NET CORE 2.0 framework released 14 Aug 2017.

Technologies:

- Microsoft ASP.NET CORE 2.0 Framework
- C#, Javascript, HTML, CSS, SQL
- Microsoft SQL Server 2016

3 - "XMRemoteRobot" - Demo as web pages

"XMRemoteRobot" - One Human Commander can command many robots.

Audience Participation to test this.
Navigate to the "XMRemoteRobot" home page - then when we are ready, click "Robot01" on the menu:

XMRemoteRobot Test Server - Auckland, NZ

We then look at "Robot02" which shows the light patch effect.

The presentation plan was to call on audience volunteer "Human Commanders" to run "Test01" and "Test02". On 07 Sep, I skipped this to make sure of having enough time for the "RoboSnake" demo.

Post-conference: readers are welcome to visit pages "Test01" and "Test02" and run the app. On most screen displays you can "command" on the left and see the results in a display on the right. That display is a separate web page and your signals journey from the left panel to the remote server then back to the right panel.

4 -
Demo - Remote Control Vehicle "The Creative Rat"

Youtube Video:

https://www.youtube.com/watch?v=aVQCipqSoCs

5 - Analogue Approach hits barriers.

A sensitive "555" control circuit for servo control pulses is vulnerable to interference, especially from the notoriously noisy "Brushed DC Motor".

This pushes me to investigate microcontrollers. Pleasant surprises!
"ATtiny-85 First Impressions - Excellent"
https://hitechfromlotech.blogspot.co.nz/2017/08/attiny85-microcontroller-first.html

Video of 555 and servo. The servo is not supposed to jiggle like this!

https://www.youtube.com/watch?v=ADcx4mQAyv0

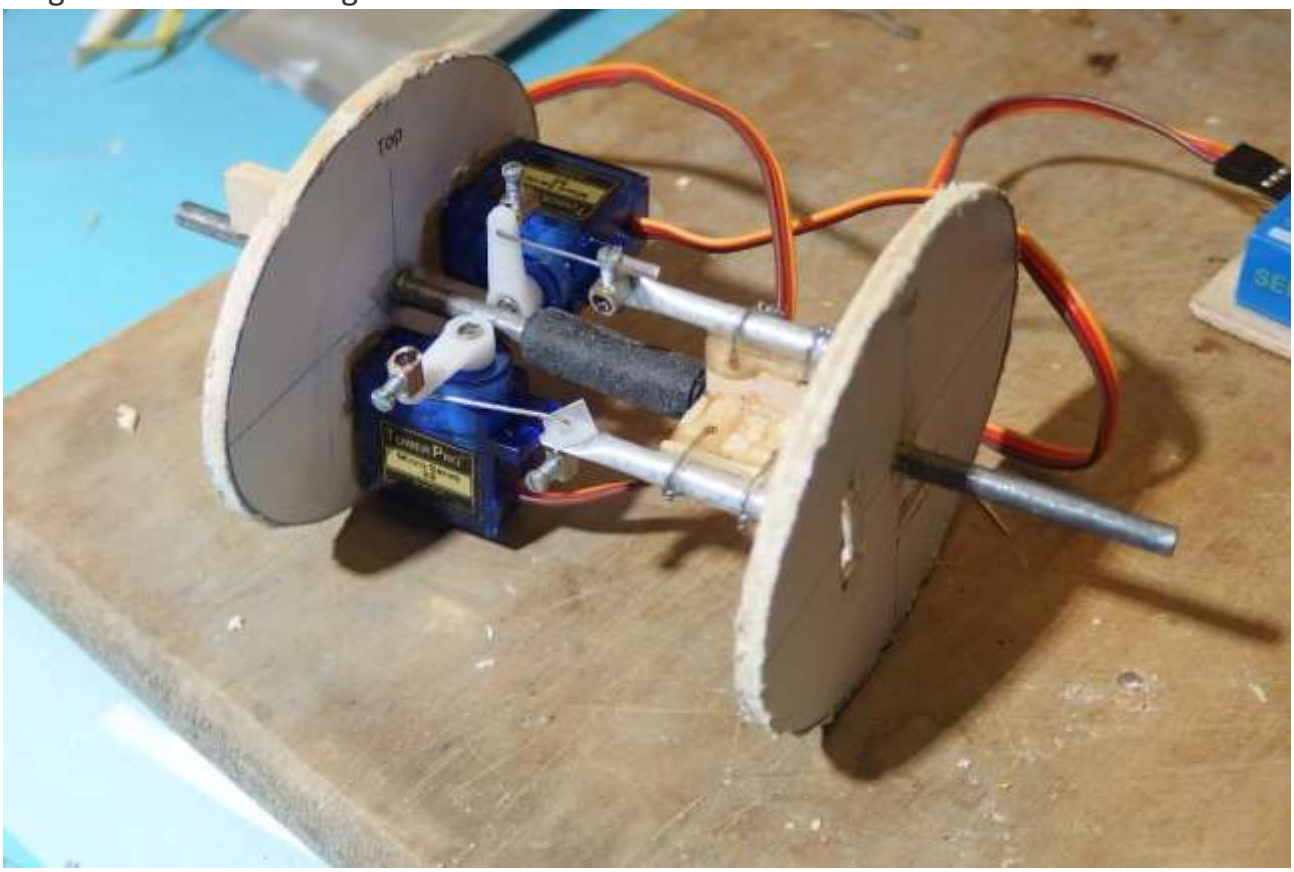
6 - RoboSnakes

Why RoboSnake? (aka SnakeBot).
Maybe a good form factor for a robot rat hunter in NZ Bush conditions.

Prototyping starts with test single segments.

In the conference presentation, I had 2 of these, the "analogue snake" and the "digital snake". I called for audience volunteers to operate these. "You've heard of 'break dancing' - so now do 'snake dancing'". I asked the audience to vote on which snake was doing the best dance and the "digital snake" was the clear favourite.

"Digital Snake" still image:



"Digital Snake" video:

https://www.youtube.com/watch?v=gWxlmtNSKdw

Question for the audience - From Page 1:

We have chocolate fish prizes for audience participation … but what other piece of kiwiana features in this presentation?

Answer:

Number-8 Wire! Good value for robot skeletons. Spot it in the photo above.

6 - RoboSnakes - continued …

"Analogue Snake" video:
Prototyping a "bio-inspired" approach with kevlar "tendons". Possibly more resilient to outside forces than the servo construction because we can incorporate rubber sections in the "tendons".
Still considering constructing something like this but driven by digitally controlled servos as in the "Digital Snake" above.

https://www.youtube.com/watch?v=gABg13oMqEs

Sources:

Dowling, K., (1997). *Limbless Locomotion: Learning to Crawl with a Snake Robot* [Doctoral Thesis, Carnegie Mellon University, 1997]. Retrieved from: https://www.societyofrobots.com/robottheory/limbless_locomotion.pdf

Hirose Serpenoid Motion Formula as quoted by Dowling:

$$x(s) = sJ_o(\alpha) + \frac{4l}{\pi}\sum_{m=1}\frac{(-1)^m}{2m}J_{2m}(\alpha)\sin\left(m\pi\frac{s}{l}\right)$$

$$y(s) = \frac{4l}{\pi}\sum_{m=1}^{\infty}(-1)^{m-1}\frac{J_{2m-1}(\alpha)}{2m-1}\sin\left(\frac{2m-1}{2}\pi\frac{s}{l}\right)$$

Shigeo Hirose, Tokyo Institute of Technology, is a prominent researcher in this field.
News coverage:
http://thefutureofthings.com/6061-amphibious-snake-like-robot/

Interview, 2013
http://www.titech.ac.jp/english/research/stories/shigeo_hirose.html