Overview

- An alternative arrayforth toolchain
- Gesture recognition on GA144
- Chlorophyll modifications
- Sensortag application
- Demo

Another Arrayforth Toolchain

- compiler, simulator, bootstreamer, and disassembler
- supports work with Chlorophyll, also useful by itself
- linux interoperability

Before:

- Compile Chlorophyll source
- Convert to colorforth format
- Open colorforth IDE
- Compile
- Manually set the boot descriptors
- Load
- Repeat until madness

Now:

- single command to compile and load

Compiler

- No semantic color **: add10 0xa +**
- Address literals: **&wordname**
- Automatic **nop** insertion
- north, east, south, west => up, down, left, right
- Resolves forward word references
- **word@node** for compiling calls to words in other nodes
- Arrayforth Emacs mode
- Currently no support for generalized host computations during compilation

Bootstreamer

- Generates bootstreams for async(node 708) or 2wire (node 300)
- Supports streaming programs into host chip through target chip
- Supports most boot descriptors **/p /a /b /io**
- Currently no support for **/stack**

GA144 Simulator

- Supports most features
- Debugging
  - Unlimited breakpoints
  - Break on instruction word, function name, io pin change
  - Display current state, disassemble memory
- Currently no support for
  - phantom wakeup signals
  - parallel bus
  - serdes
- Multi-chip simulation, can ‘wire’ them together
- No GUI (yet?)
- Demo?

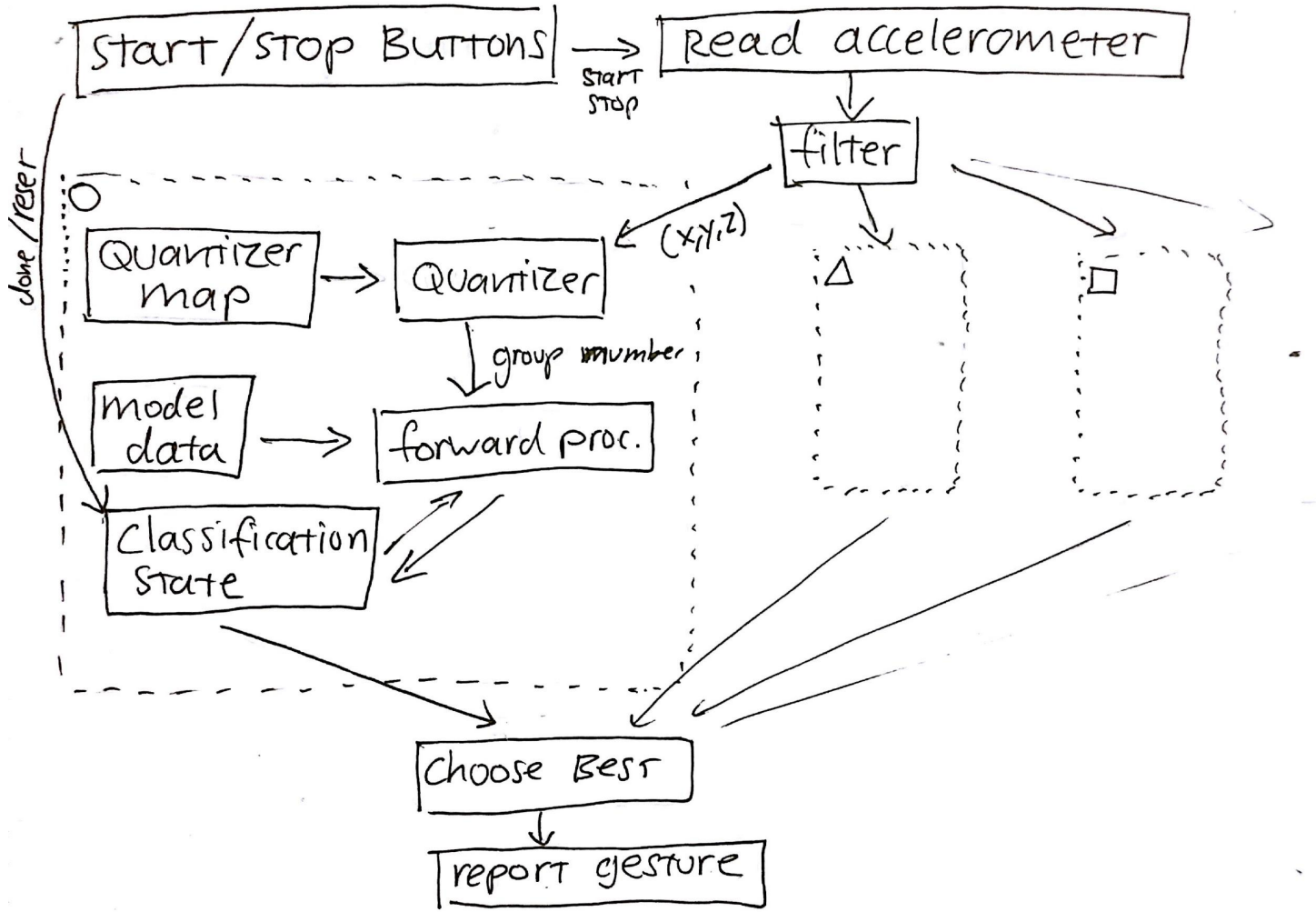
Gesture recognition on GA144

Use hidden markov models to classify gestures

Stream accelerometer values to hmm models

Model training done on PC

- For each accelerometer measurement:
  - Filter - idle state, directional equivalence
  - Quantizer
  - Step forward procedure


Start/Stop Buttons
start
stop
Read accelerometer
filter
done/reset
(x,y,z)
Quantizer map
Quantizer
group number
model data
forward proc.
Classification state
Choose Best
report gesture

Chlorophyll Evolution - Adding ‘actors’

Problem:

- high density code around IO nodes
- too much communication

Solution:

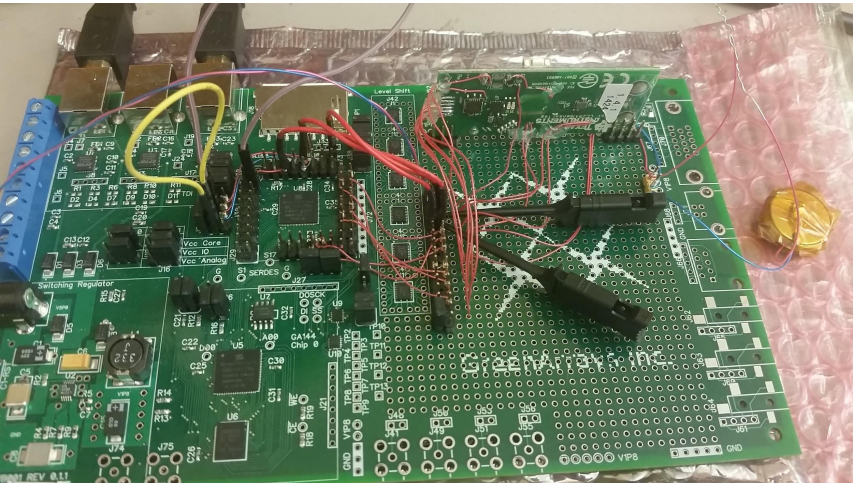
- Separate functions that communicate via port executable ‘messages’
- Inspired by actor model of concurrent computation

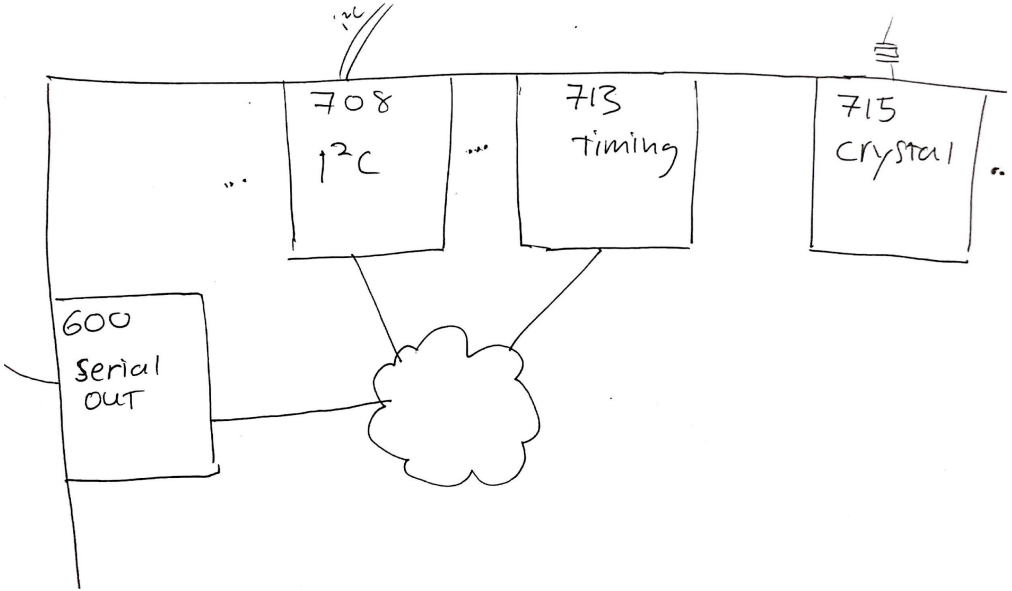
actor read_accelerometer@(8~>7);

Sensortag

Implemented part of the sensortag application in Chlorophyll

Based on Greenarrays AN012





Chlorophyll vs. Arrayforth

Crystal control

```
node 715
: -osc over
  io b! for
  0x30000 !b dup .. 2/ dup for unext
  0x20000 !b .. over 1 and .. + for unext next
  dup or !b dup 30000 for
  drop @b - -while next ;
  then dup or pop drop ;
: clang
  12470  2000 for dup 5000 -osc while
  drop 1 . + next clang ; then
: prep
   0 0x20000 0x800 0x30800 0 0x20000 0x800 0x30800
   dup up a! drop
: run !b !b @ drop run ;
: main south a! clang ;
```

```
void osc(int@1 k)
  for (i from 0 to 5000){
    set_io(715, SOURCE);
    delay_unext(715, k);
    set_io(715, SINK);
    delay_unext(715, k);
  }
  set_io(715, IMPED);
  for (i from 0 to 30000){
    if (digital_read(715, 0)){
      while (1){
        set_io(715, SOURCE);
        set_io(715, HIGH_IMPEDANCE, WAKEUP_LOW);
        digital_wakeup(715);
        set_io(715, SINK);
        set_io(715, HIGH_IMPEDANCE, WAKEUP_HIGH);
        digital_wakeup(715);
      }
    }
  }
}

void crystal_init(){
  int@1 period;
  period = 12900;
  while (1){
    osc(period >>@1 1);
    period = period +@1 1;
  }
}
```

https://github.com/mangpo/chlorophyll

https://github.com/mschuldt/ga144