



SNAP – Sensor Network Application Plugin

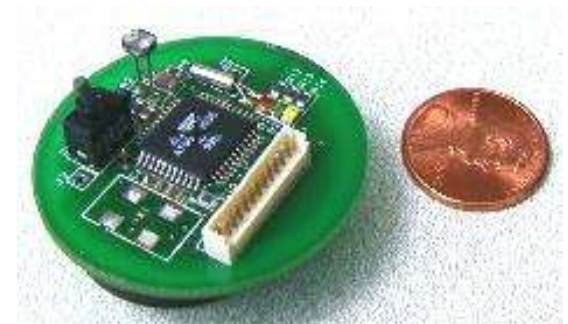
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Contributions

- Propose SNAP – Sensor Network Application Plugin
 - C++ classes based on TinyOS
 - Plugin

Background

- Sensor Networks
 - Small, energy-constrained, distributed nodes
 - wireless
 - Self organized after deployed
- TinyOS - the soul of the nodes
 - Small footprint
 - Component-based
 - Event-driven
 - Fast content-switching



Problems

- TinyOS-0.6.1
 - Lots of macros, difficult to use
 - Extra description file, could become inconsistent
- TinyOS-1.X.X
 - New language, nesC
 - Extra configuration file
- No plugin support

Solutions

■ SNAP

- C++ classes - information hiding, polymorphism
- Simple, concise
- Multiple inheritance to wire components – no configuration file
- Using libraries - shorter compilation time
- Plugin-based

Evaluation

```
#include "tos.h"
#include "BLINK.h"

TOS_FRAME_BEGIN(BLINK_frame) {
    char state;
}
TOS_FRAME_END(BLINK_frame);

char TOS_COMMAND(BLINK_INIT)(){
    TOS_CALL_COMMAND(BLINK_LEDr_off());
    TOS_CALL_COMMAND(BLINK_LEDy_off());
    TOS_CALL_COMMAND(BLINK_LEDg_off());
    VAR(state)=0;
    TOS_CALL_COMMAND(BLINK_SUB_INIT)(tick1ps);
    return 1;
}

char TOS_COMMAND(BLINK_START)(){
    return 1;
}

void TOS_EVENT(BLINK_CLOCK_EVENT)(){
    char state = VAR(state);
    if (state == 0) {
        VAR(state) = 1;
        TOS_CALL_COMMAND(BLINK_LEDr_on());
    } else {
        VAR(state) = 0;
        TOS_CALL_COMMAND(BLINK_LEDr_off());
    }
}
```

```
include modules{
    MAIN;
    BLINK;
    CLOCK;
    LEDS;
};

BLINK:BLINK_INIT MAIN:MAIN_SUB_INIT
BLINK:BLINK_START MAIN:MAIN_SUB_START

BLINK:BLINK_LEDy_on LEDS:YELLOW_LED_ON
BLINK:BLINK_LEDy_off LEDS:YELLOW_LED_OFF
BLINK:BLINK_LEDr_on LEDS:RED_LED_ON
BLINK:BLINK_LEDr_off LEDS:RED_LED_OFF
BLINK:BLINK_LEDg_on LEDS:GREEN_LED_ON
BLINK:BLINK_LEDg_off LEDS:GREEN_LED_OFF
BLINK:BLINK_SUB_INIT CLOCK:CLOCK_INIT
BLINK:BLINK_CLOCK_EVENT CLOCK:CLOCK_FIRE_EVENT
```

Evaluation (cont)

```
#include "plugin.h"
#include "leds.h"
#include "clock.h"

class Blink : public Plugin,
              public Leds, public Clock {
protected:
    void fire(void) {
        redToggle();
    }

public:
    Blink(void) : Clock(tick1ps) {
    }
};

PLUGIN(Blink);
```

Evaluation (cont)

Application	TinyOS	SNAP	Diff
Blink	1078	1268	190
Sense	1590	2562	972
Sense2	1740	2770	1030
sens_to_leds	1652	2546	894

Application	TinyOS	SNAP	Diff
Blink	4	16	12
Sense	14	52	38
Sense2	14	66	52
sens_to_leds	14	52	38

Only 0.8K larger

Evaluation (cont)

- **PLUGIN**

- Forward compatibility as plugins
- No code modification

Conclusion & Future Work

- Propose SNAP
 - Small, concise and OO
 - Plugin forward compatibility
- PDP – Plugin Dissemination Protocol