ECE 471 – Embedded Systems
Lecture 24

Vince Weaver

http://web.eece.maine.edu/~vweaver

vincent.weaver@maine.edu

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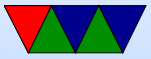
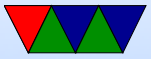
Announcements

- HW#8 was posted
- Keep thinking about projects, topic due Friday.



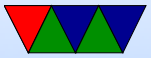
Midterm Review

- Booting on the Pi
  - What a bootloader does
  - Why Pi is unusual
- Real Time
  - Definitions
  - Is this hard, soft, firm
- i2c/SPI/1-wire
  - Know the tradeoffs between i2c, SPI, 1-wire
  - Be able to follow the C code for them



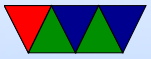
HW#7 Review – Questions

- Anti-lock brakes hard/soft/firm realtime?
  Hard. If things go wrong would be disaster
- Stereo change channel hard/soft/firm realtime?
  Soft. Prefer it not to be late, but still want to happen
- Video coming in at 60fps decoding?
  Firm, if frame decoded late it is useless
- Disadvantage of SPI?
  More wires, no standard, no errors
- Advantage of SPI?



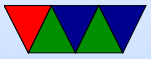
Lower Power, Full Duplex, No max speed

- TMP36 on end of cable.
  Voltage Drop, Noise?
  Datasheet has two options, convert to current, or an extra resistor.
- Minimum frequency of 10kHz or results invalid. Maybe cannot go this fast if bitbanging via GPIO. Also context switch in middle, Linux not realtime?



HW#7 Review – Linux "fun"

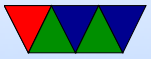
- /dev/null
- /dev/full
- /dev/zero
- /dev/random – give explanation on sources of randomness (entropy), pseudo-randomness, etc.
- Mention related DOS/Windows compatibility issue



C string review

String manipulation is famously horrible in C. There are many ways to get the "YES" and "t=24125" values out of the text file for HW#8. Any you choose is fine.

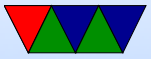
- There are multiple ways to read files into a string in C
  Assume `char string[1024];`
  - `fd=open("filename",RD_ONLY);`
    `read(fd,string,1023); close(fd);`
  - `FILE *fff; fff=fopen("filename","r"); fread(bu`
    `fclose(fff)`



You can also use `fgets(buffer,size,fff);`

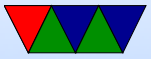
- Advanced: use `mmap()`

- C strings
  - In C, characters are NUL (0) terminated character arrays (usually 8-bit bytes). Usually ASCII or UTF8
  - Other languages might be unicode, 16-bit, wchar
  - You can use either pointer or array access to get a value (string[0] is the same as *string)
  - Note that double quotes indicate a string, while single quotes indicate a single character
  - It is very easy to accidentally go off the end of a string



and corrupt memory
  - Alternatives? Fancy libraries? Pascal strings (where first char is the length?)
  - Always be sure your strings are terminated, otherwise bad things can happen (and not all C string manipulation functions do this properly, see strcpy(), strncpy(), strlcpy()
- Finding a location / substring in a larger string

  - If you trust the Linux kernel developers to keep a "stable ABI" you can assume the temperature will always be a fixed offset and hard code it. This can be



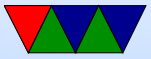
a bit dangerous.

- You can use the `scanf()` series of functions to parse the string (either fscanf() directly, or sscanf() on the string)

  One helpful hint, putting a '*' in a conversion (like `%*s` tells scanf to read in the value but ignore it.
- You can use the `strstr()` search for substring C-library function, maybe in conjunction with `strtok()`
- You can manually parse the array.

  Using array syntax, something like:

  ```
  i=0; while(string[i]!=0) {
  ```

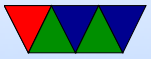


```
if (string[i]=='t') break; i++ }
```

Using pointer syntax, something like:

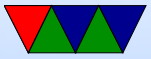
```
char *a; a=string; while(*a!=0) {
if (*a=='t') break; a++; }
```

- Pointing into a string
  - If you searched for "t=" you might now have a pointer a to something like "t=12345". To point to 12345 you can just add 2 to the string pointer.
  - `printf("%s\n",string+2);`
  - `printf("%s\n",&string[2]);`
- Converting string to decimal or floating point



- `atoi()` converts string to integer. What happens on error?
- `strtol()` will give you an error but is more complex to use
- `atof()` and `strtod()` will do floating point

- Comparing strings
  - Can you just use ==? NO!
  - Be careful using `strcmp()` (or even better, `strncmp()` they have unusual return value
    less than, 0 or greater than depending. 0 means match
    So you want something like



```
if (!strcmp(a,b)) do_something();
```