UNIVERSITY OF COPENHAGEN



CyberBear: Hack an IKEA Bear into an IoT Product

FemTech Workshop for STX/HTX students, April 2017

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Human Centred Computing (HCC) Department of Computer Science (DIKU)



Lets start to get to know each other

What is your favorit movie or serie?

What kind of music do you like?

What are your expectations for today?



What are we going to do?

- Hack an IKEA bear into an IoT product
- Learn how to create and built an Interactive Product using micro-controllers

- Learn Par-programming
- Learn Micro-controller Programming
- Learn to use Electronic textile as hardware



How are we going to do this?

Morning: Introduction to Arduino & the Thing

- Introduction to Par Programming
- Hello World!! Making the Thing blink?
- Making an LED blink play with blinking patterns
- Built a button to control the LED blink
- Get the Thing on the Internet when pressing the button

Afternoon: Hack the IKEA bear

- Create a textile button and add it to your circuit
- Wire up the Thing with conductive thread
- Sew the Thing on the IKEA bear
- Sew the textile button on the IKEA bear
- Sew the LilyPad LEDs on the bear



Beyond the FemTech Workshop

FemTech.dk is a research project with the aim of creating new ways to facilitate inclusion in digital technology development by experimenting with new teaching methods

We have invited you to try out these new methods and then learn from you what works and what can be improved

Therefore we will ask you questions and collect information about this event, which we then use for research using video, audio recordings, and pictures (please help us)



What do we hope to gain from the FemTech workshop?

- We want you succeed in creating your own IoT Cyber Bear to take home
- We want you to succeed in putting your Cyber Bear on your local WIFI at home
- We want you to bring your Cyber Bear to your class and explain to others what you did and how cool it is
- We want you to help us create a small 'workshop exclusive FemTech' community, where you can share idea about technology with each others, while helping us to create future workshops for others

Questions or Comments?

Internet: Pernille Bjorn Password: asyouwish



FemTech.dk



Making Interactive Technologies



FemTech DIKU

RECENT POSTS

DIKU Human centred computing researchers invites STX/HTX students for a FemTech event

FemTech DIKU



DIKU Human centred computing researchers invites STX/HTX students for a FemTech event

At the Human-Centered Computing (HCC) section at University of Copenhagen Computer Science department (DIKU), we are researching new al-



Par Programming

Navigator

Driver





You will be working in groups – shifting roles as navigator and driver - you will do everything twice in each group







What is the cool thing about micro controllers?



Hello World!!! Making the Thing blink

First we need to install drivers:

- Arduino IDE
- Sparkfun ESP8266 Thing Dev

Then we make the Thing blink

Internet: Pernille Bjorn
Password: asyouwish
Website: Femtech.dk
FemTech event: Hack an IKEA Bear into a Cyber Bear
1) Installing Arduino IDE
2) Sparkfun ESP8266 Thing Dev
3) Hello world – making the Thing blink



Navigating the Arduino IDE (examples)

🥺 sketch_nov18a Arduino 1.5.8	8					
File Edit Sketch Tools Help						
New Open Sketchbook Examples	Ctrl+N Ctrl+O	01.Basics 02.Digital 03.Analog		AnalogReadSerial BareMinimum Blink		
Close Save Save As Upload Upload Using Programmer	Ctrl+W Ctrl+S Ctrl+Shift+S Ctrl+U Ctrl+Shift+U	04.Communication 05.Control 06.Sensors 07.Display 08.Strings		DigitalReadSerial Fade ReadAnalogVoltage		
Page Setup Print	Ctrl+Shift+P Ctrl+P	09.USB 10.StarterKit ArduinoISP	•			
Preferences Quit	Ctrl+Comma Ctrl+Q	Audio Bridge	•		Hardware	
•		Esplora Ethernet	•		Haraware	Interne
		Firmata GSM LiquidCrystal Robot Control	> > >		Softwa	re
		Robot Motor Scheduler	•			

Arduino IDE





When something goes wrong....

Check the port

💿 sketch_nov17a Ar	duino 1.5.8		X	
File Edit Sketch Too	ls Help			
<pre>sketch_nov17a void setup() { // put your se</pre>	Auto Format Archive Sketch Fix Encoding & Reload Serial Monitor	Ctrl+T Ctrl+Shift+M		sketch_nov File Edit Sket sketch_nov17: void setup()
3	Board	•)) pao joan
void loop () [// put your ma	Port Programmer		COM3 COM6	void loop()
)	Burn Bootloader			3
			Ţ	4
•			Þ	
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				nedia yer
9		Arduino Uno	on COM5	
nedia				10

Check the board

a | Arduino 1.5.8



Check the wiring!!

Find in reference

<pre>void setup() { // put your setup code here, to run once: serial.begin(9600); } void loop() { // put your main code here, to run repeatedly: Serial.println("This is a print statement"); Serial.println("This is a print statement"); Serial.println("kikis); Serial.println("kikis"); Cut Cut Cut Copy Copy shTML paste Ciset All </pre>
Cut Copy Copy Copy for Forum Copy as HTML Paste Colst All
Select All
Comment/Uncomment
Do Increase Indent Decrease Indent 15%) of dynamic memory, leaving 1, byt Find in Reference

- Make sure to turn off the Thing and unplug
- Sometimes you need to shut down Arduino IDE
- Sometimes you need to shut down/restart your computer



Power USB

computer

Lets built something!







Breadboard – to help us connect stuff to the Thing







Lets make an external LED turn on (wiring up the board)





Lets make an external LED turn on (the code)

```
Upload
 Blink S
 modified 8 May 2014
 by Scott Fitzgerald
 * /
const int ledPin = 14:
// the setup function runs once when you press reset or power the board
void setup() {
 // initialize digital pin 13 as an output.
                                             Try to change the
 pinMode(ledPin, OUTPUT);
                                             blinking pattern
}
// the loop function runs over over again forever
void loop() {
  digitalWrite(ledPin, HIGH); // turn the LED on (HIGH is the voltage level)
                          // wait for a second
  delay(1000);
  digitalWrite(ledPin, LOW); // turn the LED off by making the voltage LOW
  delay(1000);
                         // wait for a second
```

Changing blinking patterns (Creating a method and calling it later in the code)

}

Blinking patterns in the loop

```
// the loop function runs over
void loop() {
 digitalWrite(ledPin, HIGH);
 delay(1000);
                             //
 digitalWrite(ledPin, LOW);
 delay(1000);// wait for a sec
 digitalWrite(ledPin, HIGH);
 delay(500);
                           // w
 digitalWrite(ledPin, LOW);
 delay(500);
 digitalWrite(ledPin, HIGH);
 delay(1000);
                            //
 digitalWrite(ledPin, LOW);
 delay(1000);
}
```

Try to write the FOR method and calling it in the loop

```
void blinking_LED (const int output_led, int delay_nr, int total_blink){
 digitalWrite(output_led, LOW);
 for (int i = 0; i<total_blink; i++)</pre>
 ł
   digitalWrite(output_led, HIGH);
   delay(delay_nr);
   digitalWrite(output_led, LOW);
   delay(delay_nr);
 }
         Calling the Blinking patterns method within the loop
  if (response == 0)
    //LED_PIN = output for blinking, for how long, and how many times
    blinking_LED (LED_PIN_GREEN, 500, 5);
  } else if(response == 1)
  {
    blinking_LED (LED_PIN_RED, 500, 5);
  }
```

Blinking patterns method (outside and before the loop

Department of Computer Science, DIKU

BREAK

Lets make a button to control the LED (wiring)



Adding to the breadboard

- Orange/brown resister (GND-Button)
- Green (signal) to button go to Pin13
 Button to +



Lets make a button to control the LED (code)



Lets get the Thing on the Internet

Hardware Internet

Software

- FemTech.dk choose point 5)
- Open a new sketch and paste in the code
- Open the Serial monitor to see what is going on

- Lets look at the code
- Connecting the a Network with password
- Connecting to a website
- Sending a request to a server
- FOR loop for blinking patterns (notice you have only one LED attached to a pin right now)
- Setup (once)
- Loop (continuously)

Software

The FemTech Server

Hardware Internet

FemTech server:

- 1. http://femtech.dk/cyberbear
- 2. http://femtech.dk/cyberbear/cansnooze.php
- http://femtech.dkh/cyberbear/cansnooze.php?gymId=[Id of school]&elevId=[Id student]
- 4. http://femtech.dk/cyberbear/isnorain.php?cityname=[]
- 5. http://femtech.dk/cyberbear/isnorain.php?cityName=[Name of the city]
- 6. http://femtech.dk/cyberbear/isfriday.php

client.println("GET http://femtech/cyberbear/isnorain.php?cityName=[Copenhagen] HTTP/1.0");

Change you HARDWARE to fit

const int BUTTON_PIN = 14; //where your button signal is incoming const int LED_PIN_RED = 16; // red LEDs for pin 16 YOU DO NOT HAVE THIS IN YOUR CURRENT SET UP const int LED_PIN_GREEN = 13; // green LEDs for pin 13



- <u>Parent Directory</u>
- <u>cacert.pem</u>
- <u>cansnooze.php</u>
 isfriday.php
- isnorain.php
- lectio.php
- readme.txt
- <u>simple_html_dom.php</u>

Finding your school ID and student ID in Lectio









DRAWING and QUESTION

1) What interactive product could you imagine developing with the knowledge you have now

2) What do you know now about technology development now that you did not know this morning?

Make a drawing/Brainstorming together



Welcome back

Any questions or comments which you discussed or though about during lunch you want to share?





Agenda

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Who is CyberBear?

Hardware Internet

User scenario

- Sleeping longer
- Is it not raining?
- Is it Friday?





What do CyberBear really do?





Lets create a Textile Button

Rigid Electroncs vs Soft Circuits



Curtesy of Paul Strohmeier <p.strohmeier@di.ku.dk>



Textile Button





Adding the textile button to the circuit



TRY with tape first and test it out with your current hardware setup replacing the button on the breadboard

Wire the Thing up with conductive thread



Pull conductive thread through all the pins we need, tie a knot and potentially put plastic flex on to make it stay. The end result you should have conductive thread in six pins (three on each side) using GND close to the USB socket.

We need **6 conductive thread** in pins **16, 13, and GND** (on the left side of the board) and in **pin 5V, 14, and GND** (on the right side)



Attach the Thing to the IKEA bear (upside down)





Sew up CyberBear textile button



- Sew threads from pin 5V, pin14, and GND to the button. Make sure they do not touch
- Sew pin16 to + on the Red LED (over the shoulder of the bear)
- Sew pin13 to the + of the Green LED (under the arm)
- Sew GND to the of the Green LED and continue to the of the Red LED and end.



Sew up CyberBear with LilyPad LEDs (check +/-)



DRAWING and QUESTION

- 1) What interactive product could you imagine developing with the knowledge you have now?
- 2) What do you know now about technology development now that you did not know this morning?

Make a drawing/Brainstorming together



Plenum

- What worked well?
- What could be improved?
- If you were to describe what you have been creating today to your class at home, what would you say?



After the FemTech event

- 1) Get CyberBear on your home WIFI (only 5V!!)
- 2) Share experience on FaceBook (picture)
- 3) Pimp up your CyberBear and share picture
- 4) Bring CyberBear to school and present 10 min about what it is and what it can do, and how you made it? (sent us a video)
- 5) Write us an email about your experience what worked what could be improved?
- 6) Next workshop ideas for new Interactive Products?



Questions & Comments?



How does the Textile Button work?

Vin= Voltage input = 5v



Vout = Voltage output

We are using digitalRead = 0/1(2.5 = `1'; 0.4 = `0'

Pressure on fabric resistor = *much* lower resistance

$$V_{
m out}=rac{R_2}{R_1+R_2}\cdot V_{
m in}$$

f R_1 = R_2 then $V_{
m out}=rac{1}{2}\cdot V_{
m in}$

- R1=R2: 10/(10+10)=1/2 of 5V = 2.5V
- R1<R2: 10/(1+10)=10/11 of 5V = 4.5V
- R1>R2: 1/(10+1)=1/11 of 5V = 0.4 V

