Bridging perceptions

research document

Digital Craft

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A brief history of VR

The humankind has always been fascinated by new realities and perceptions. To be able to experience a different reality and so have the idea of being elsewhere is something we as humans have always been dreamed about.

Panoramic paintings from the year 1800 suggest the first signs of the idea of creating the illusions of experiencing a different reality or moment in time. When standing in front of such a painting the beholders view will only catch the painting. In this way the beholder could experience the illusion of being inside the moment of the actual painting and so in a different reality.

Thanks to the arrival of the computer and its graphics, completely new digital worlds can easily be built. For example, in 1920 flight simulators were used by the American Air Force for pilots to practice flying with an airplane without literally being in the air. The first real simulation of reality was the Aspen Movie Map that was introduced in 1978. This simulation gave the beholder the illusion of making a tour through the streets of Aspen, Colorado, without, of course, actually going there.

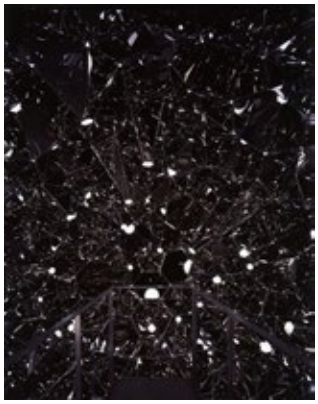
A number of flight simulators and gaming-headsets further and virtual reality has made a huge leap forward. Big brands have a huge interest in these technologies and try to stimulate as many senses as possible in order to have the complete illusion and experience of being in another reality.

Perception disorder in Art

That people are interested in new perceptions and realities is not only shown through the development of computer graphics. On the contrary, analogue techniques are used to fool the perception of man as well.

British artist Anish Kapoor uses an experiment in his work to fool the perception of the beholder only with pigments and form as tools. ‘At the Edge of the World II’ is one of his works where the beholder loses his perception of depth. The beholder stands under a huge hat where she can look up into the hat. Here the beholder is exposed to a dark color that seems to be depthless. Although the inside seems to be a depthless darkness, it is only an illusion been created with pigments.

Danish artist Olafur Eliasson uses mirrors in his work “La situazione antispettiva” to fool the perception of the beholder. Inside the installation, the beholder is confronted with a distorted reflection of himself, other beholders, the space in which she finds herself and deformed places of light. The work creates the illusion of an infinite space which at the same time ignores the central perspective.



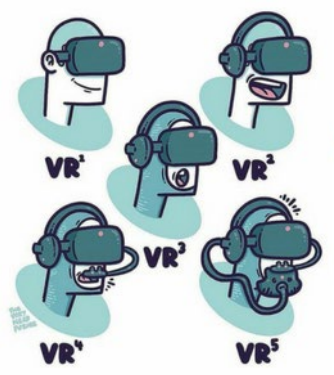
VR nowadays

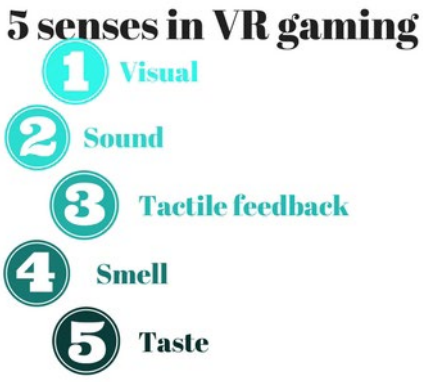
The VR technology nowadays stimulates the human senses in such a way that one has the complete illusion of being in another reality. The most used senses that are stimulated are vision, hearing and touch. Smell and taste are rarely applied, but are invested into further development so that this will become part of the virtual perception in the near future.

Because the senses are taken over to the virtual world, they can not fully or even no longer function in the physical world. As a result, the participator is no longer aware of its surroundings in the physical reality. The perception of space has completely taken hostage by the artificial world. As a result, she runs the risk of bumping into something or being touched by someone in the room.

To prevent this, a new sense is needed that can connect the virtual- and physical world with each other. A sense that one can use to protect his physical self when one is in the virtual world. A so to speak bridge has to be struck between those worlds.

We are strongly dependent on our senses to be able to perceive the world around us properly. Encouraging our senses is therefore necessary to get full perception of the (digital) reality. It is through our senses that we have a connection with the world around us. When this connection is broken by the fact that our senses are asked to function in another reality, we lose control of the physical world. Our senses can not operate in two different realities at the same time. We use different technology to give our senses the illusion of being in another reality. Only by doing this we break the contact that our senses have with the physical world around us. Because of this we are no longer able to resist in the physical world.





Adapting new senses

The environment of people is changing. We are increasingly moving to the virtual world through VR. In order to fully exploit this new world, we do not have to change our environment, we have to adapt ourselves. When the brain is exposed to the change long enough, the brain will adapt to it. This became clear during a study done on young cats in the 1960s. For the experiment, young cats were individually placed in a tube where they were only exposed to horizontal lines. A hood around the neck meant that the young cat could not even perceive its own body. As a result, the horizontal lines were the only visual images that the cat could perceive. After the cat reached the age of 3 months, he was taken out of the tube and placed in the new reality for his perception. At first the cat was unable to perceive this new world. Only horizontal movements or lines were visible to him. The interesting thing is that when the cat was exposed to the new reality for a longer period of time, he began to identify more with that reality. The brain of the cat has taken on the new reality and adapted accordingly.

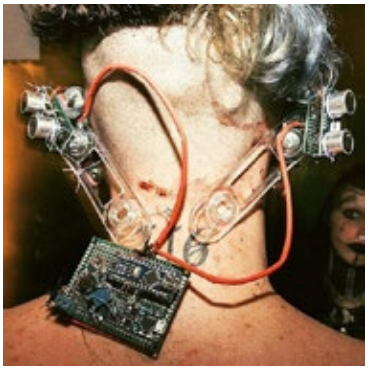
The same applies to senses. Every living creature picks up another part of reality through their senses. For example, the reality of a bat consists of air pressure waves and that of a tick of heat signals. This is called ‘Umwelt’ by scientists, which is translated into ‘the world around’ in German. Every living being thinks that his Umwelt

is the only truth of reality. That makes sense since that is the only thing the creature can observe. So each creature experiences a different reality separately from each other.

The question is whether we can expand our umwelt. Can we, humans, extend our perception of reality. The answer to that is yes. But in order to succeed we need to adjust our bodies first. By hacking the body, we hack the brain. We know that we can link technology to biology. Take hearing aids for example. We already use these technologies for the dove to be able to hear again. This adjustment is already a step towards an expandable umwelt. The brain succeeds itself in processing the new input signal and how to use it.

Neil Harbisson is seen as the first cyborg recognized by the government. He is the first person to install an antenna directly on his skull. Via this antenna, colors are converted to sound vibrations. This gives Neil the opportunity to perceive color with sound. Neil is thus one of the first to have supplemented his body with a new sense and by that meaning expanded his umwelt. It took him 3 years to completely understand this artificial sense. In the end the brain seems to work like a plug and play device. Just plug in something new and the brain figures out how to process the new input.

Artist Joe Dekni had sonar sensors implanted in his cheekbones during a preformance. This artificial organ makes it possible to observe its environment in vibrations. The 22-year-old artist always says he is fascinated by dolphins and bats that already use this naturally. Joe first had to get used to his new sense. The first vibrations he praised painfully but joyously at the same time. He wanted to expand his umwelt so that he could experience and develop new perceptions.



We as humans are experimenting with new senses to expand our umwelt and perception of our now known reality. Artificial senses are generally new. But in the near future these senses will help us to protect and understand new realities we create and explore.

Tōsen

The name Tōsen comes from the eponymous character in the anime series Bleach. Tōsen, with his Bankai attack, had the power to temporarily disable almost all the senses of his opponent. The victim had only one left, touch. Innovation within virtual reality is gaining momentum. To enable people to experience this reality in the end, the senses are taken over as much as possible. Visibility and hearing are known, but there are also developments in which touch, smell, and taste are taken over. Tōsen bridges the gap between these realities and does so by stimulating the tactile sense. Touch is, therefore, the only sense what keeps a person in the physical reality.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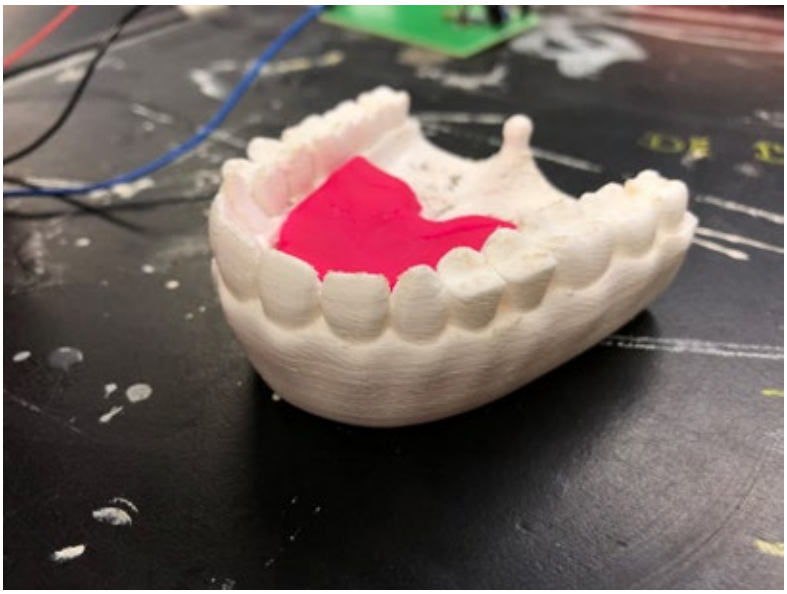
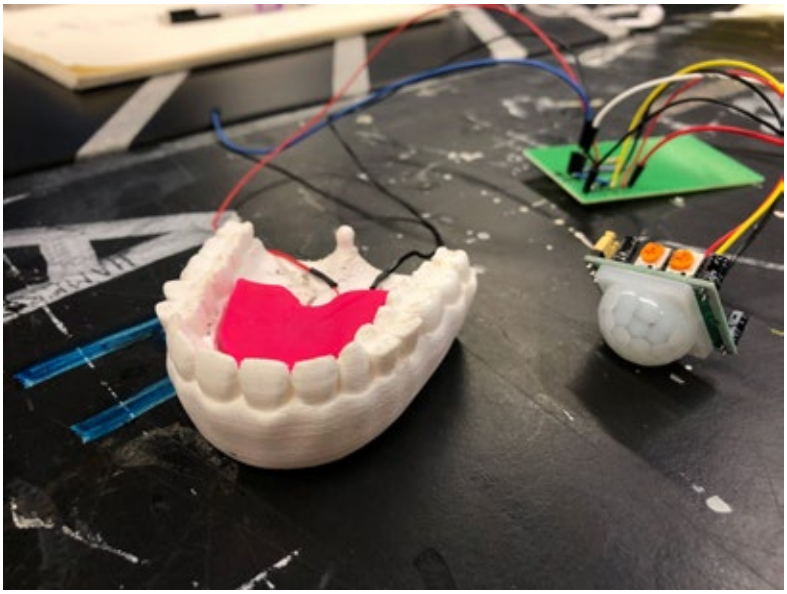
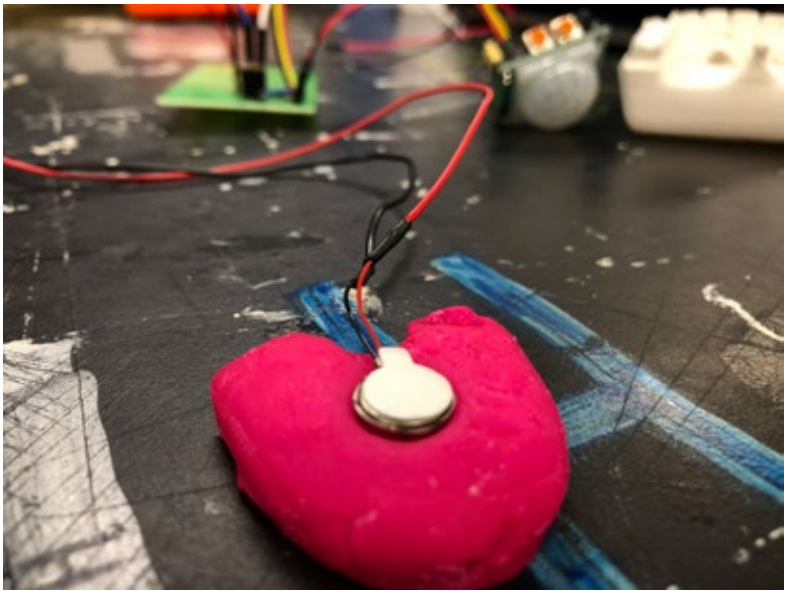
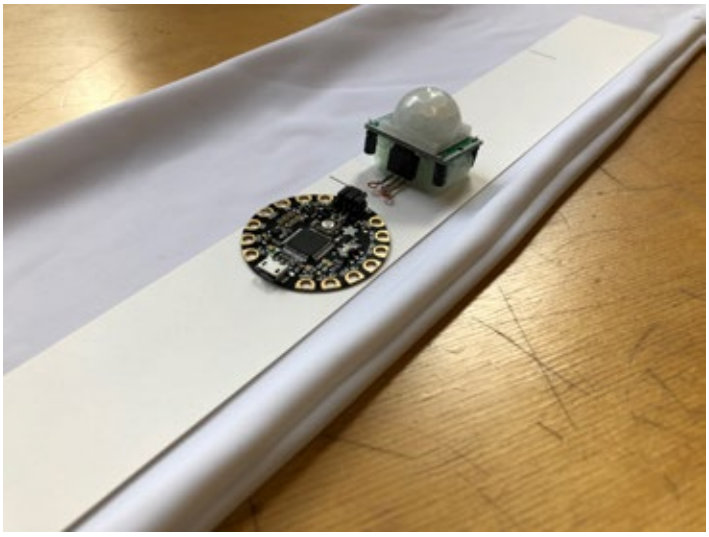
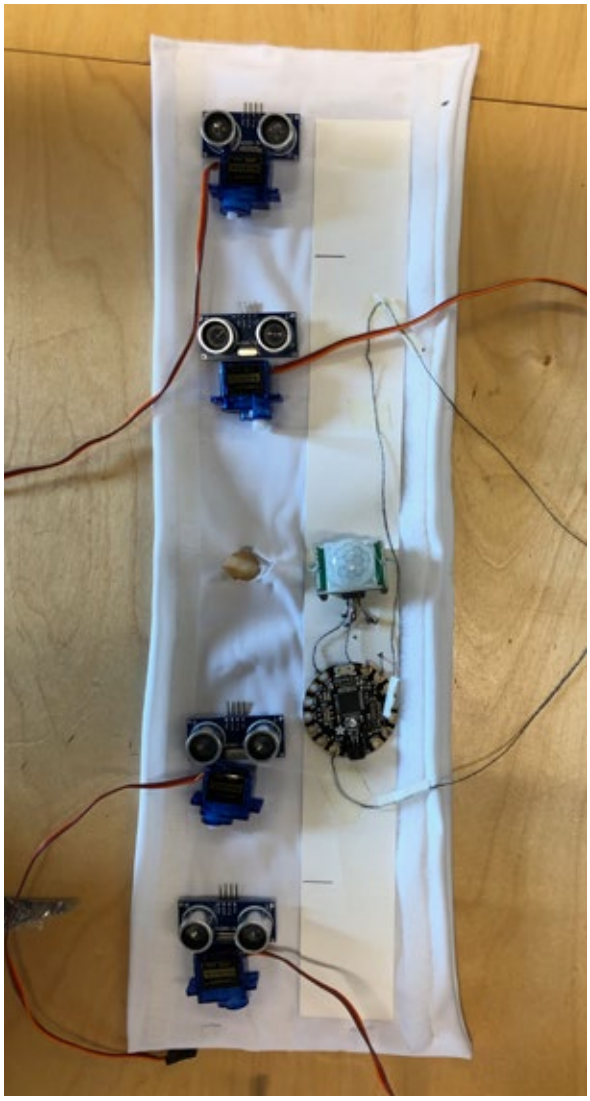
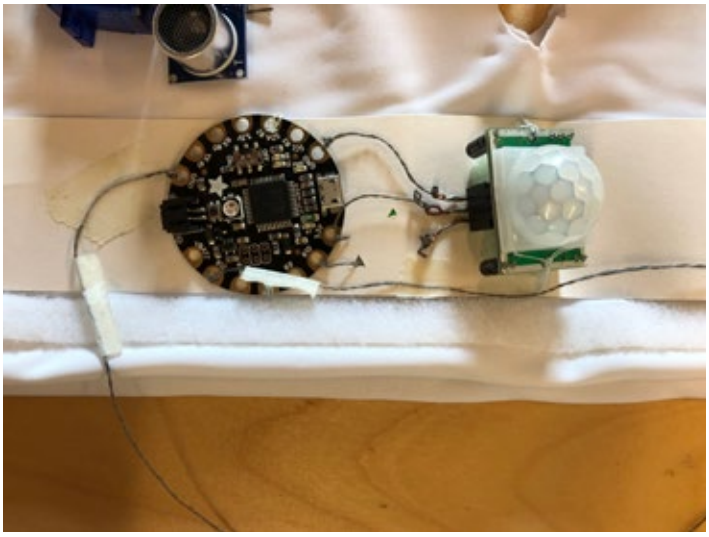






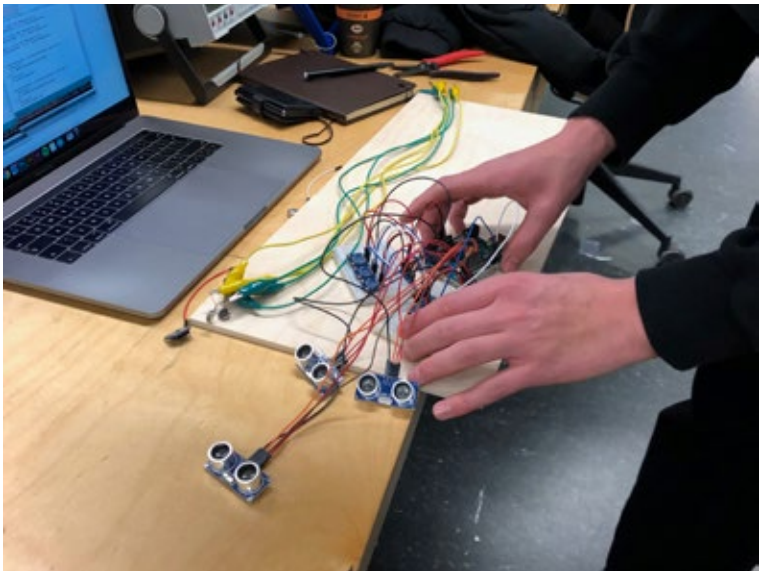


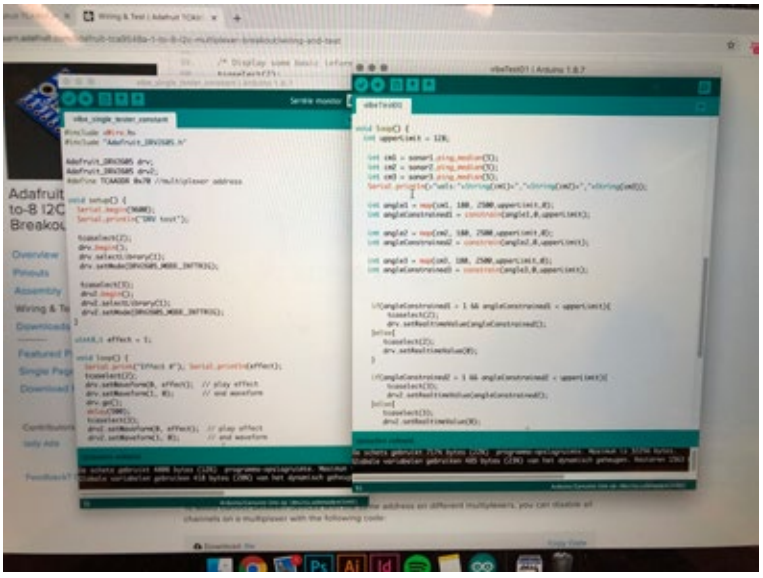


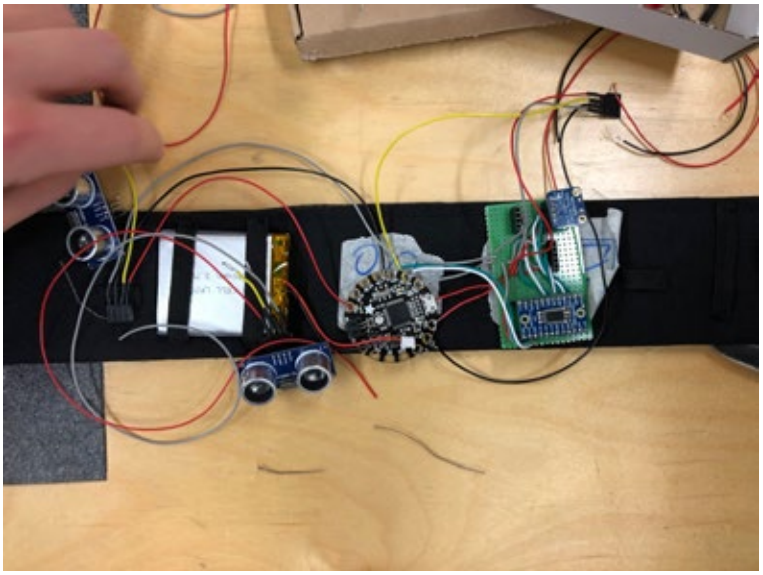


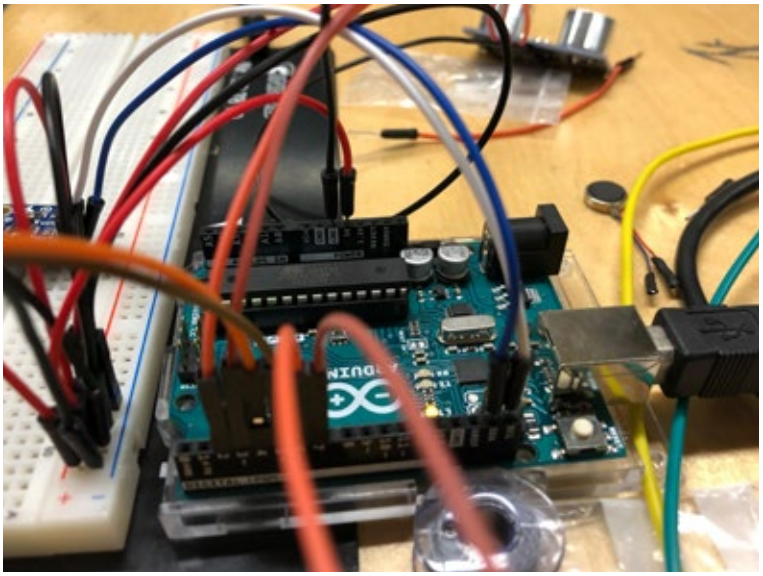
The code

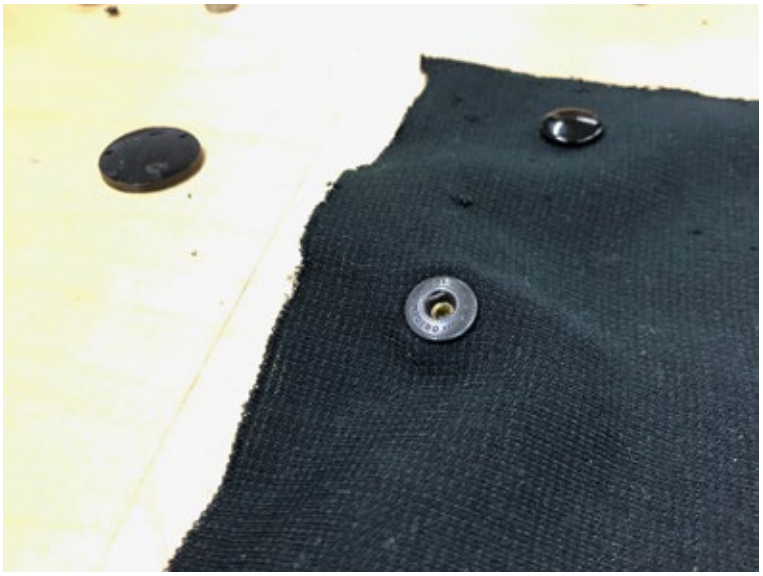
```
#include <Wire.h>
#include “Adafruit_DRV2605.h”
Adafruit_DRV2605 drv1;
Adafruit_DRV2605 drv3;
Adafruit_DRV2605 drv4;
#include <NewPing.h>

#define TCAADDR 0x70 //multiplexer address

//const int TriggerPin1 = 2;
//const int EchoPin1 = 3;

const int TriggerPin2 = 11;
const int EchoPin2 = 10;

const int TriggerPin3 = 6;
const int EchoPin3 = 7;

//NewPing sonar1(TriggerPin1, EchoPin1, 100);
NewPing sonar2(TriggerPin2, EchoPin2, 100);
NewPing sonar3(TriggerPin3, EchoPin3, 100);

void setup() {
  // put your setup code here, to run once:
  Serial.begin(9600);
  Serial.println(“DRV test”);

 /* tcaselect(1);
  drv1.begin();
  drv1.selectLibrary(1);
  drv1.setMode(DRV2605_MODE_INTTRIG);
*/

  tcaselect(3);
  drv3.begin();
  drv3.selectLibrary(1);
  drv3.setMode(DRV2605_MODE_INTTRIG);


  tcaselect(4);
  drv4.begin();
  drv4.selectLibrary(1);
  drv4.setMode(DRV2605_MODE_INTTRIG);

}

void loop() {
  int upperLimit = 128;

//   int cm1 = sonar1.ping_median(5);
    int cm2 = sonar2.ping_median(5);
    int cm3 = sonar3.ping_median(5);
   //Serial.println(+”vals:”+String(cm1)+”,”+String(cm2)+”,”+String(cm3));
    Serial.println(+”vals:”+String(cm2)+”,”+String(cm3));

  // int angle1 = map(cm1, 180, 2500,upperLimit,0);
  // int angleConstrained1 = constrain(angle1,0,upperLimit);

    int angle2 = map(cm2, 180, 2500,upperLimit,0);
    int angleConstrained2 = constrain(angle2,0,upperLimit);

    int angle3 = map(cm3, 180, 2500,upperLimit,0);
    int angleConstrained3 = constrain(angle3,0,upperLimit);

 /*    tcaselect(1);
    if(angleConstrained1 > 1 && angleConstrained1 < upperLimit){
      //  drv1.setRealtimeValue(angleConstrained1);
       drv1.setWaveform(0, 84);
        drv1.go();

    }else{
     //  drv1.setRealtimeValue(0);
    }
   delay(100);
*/
        tcaselect(3);
    if(angleConstrained2 > 1 && angleConstrained2 < upperLimit){
        drv3.setWaveform(0, 84);
              drv3.go();

        //drv3.setRealtimeValue(angleConstrained2);
    }else{
      // drv3.setRealtimeValue(0);
    }


//  delay(100);
        tcaselect(4);
    if(angleConstrained3 > 1 && angleConstrained3 < upperLimit){
        drv4.setWaveform(0, 84);
              drv4.go();

        //drv4.setRealtimeValue(angleConstrained3);
    }else{
      //drv4.setRealtimeValue(0);
    }

  delay(10);

}

//use this with the multiplexer
void tcaselect(uint8_t i) {
  if (i > 7) return;

  Wire.beginTransmission(TCAADDR);
  Wire.write(1 << i);
  Wire.endTransmission();
}
```

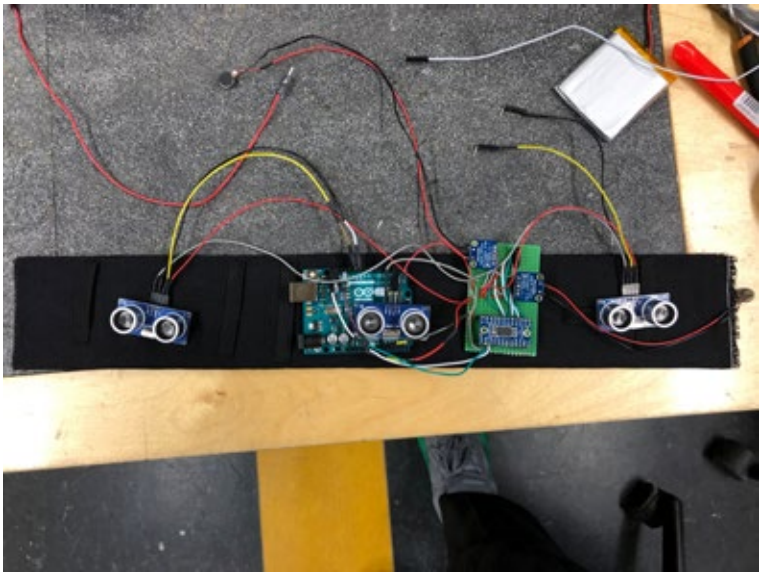


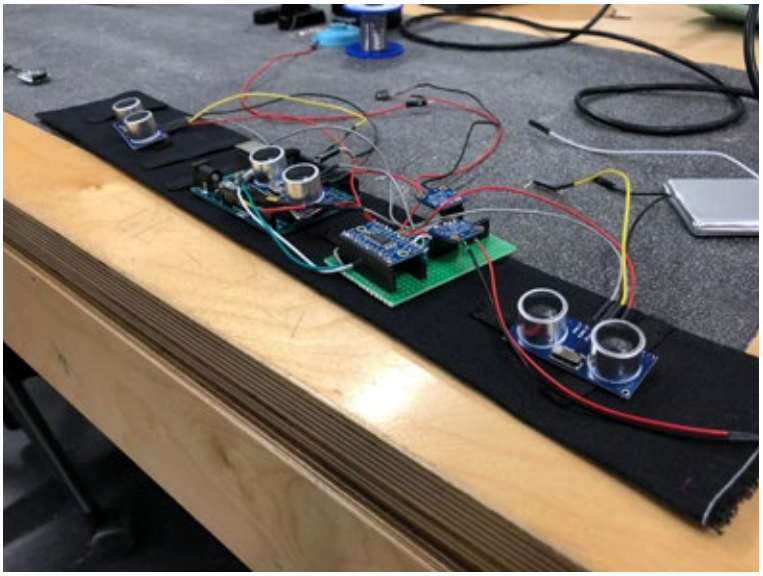













Tōsen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General reflection

The future is coming. And its coming fast. Since its almost a hype to focus on virtual realities we sometimes forget our own. Not to lose grip on the reality we know we created Tōsen. Besides that it could be a real solutions to this growing problem it's also a conversation piece it could challenge developers to think about that bridge. So we think Tōsen is not just the neckband, it's - we hope - the first tiny bridge which is going to be followed, by bigger, stronger and more advanced ones.

Personal reflection **Leon**

During the practice I learned a lot and that is mostly due to our resit. This gave us an extra chance to lift the concept to a higher level and present it as a working prototype. And that did not go without a struggle. On beforehand the concept seemed to be easy to implement, but the opposite was proven.

Tōsen is a neckband that allows the wearer to experience his environment in physical reality through haptic feedback. Sonar sensors that surround the band ensure that the neckband can scan the entire space - 360 degrees. In this way, the wearer has an extra sense that bridges the gap between the physical and virtual reality when the person is in this world. The band is part of your outfit, brings security and feels nice around the neck. To achieve this, elastic and soft textiles have been used. The user can place the wearable around his / her neck by means of a zipper on the front of the band.

Bas and I started together, but it turned out it was not the most efficient way, both of us were busy with the code, on one screen, so someone was mostly sitting next to it and watching. We decided to divide the tasks; I would focus on the technique, so the hardware and software and Bas would deal with the band, so the design and the creation. This worked very well. Bas, has more affection with textiles and I more with technology. But to keep each other sharp we shifted from chair once in a while and we looked for improvements. In this way we were able to give each other feedback and discuss some points that ultimately resulted in better alternatives or solutions. We had written the code pretty quickly. Mike Pelletier helped us a lot with this and clearly explained to me during the process what the structure of the code was and what was connected to each other. In that way I could easily add new in- and outputs to the code or adjust the parameters.

After having tested the code on an Arduino uno, we had to simplify the hardware. So a slim assemblage and replace certain parts. For example, the breadboard was replaced for a solderable one. It was quite a challenge to design the most efficient layout for the wiring since there were so many sensors. Besides shrinking the breadboard we had purchased an Adafruit Flora so that this smaller variant of the Arduino could be cleverly placed in the neck. However, we found out that the Flora could not provide the voltage that the peripherals needed to function properly. After this we decided to return to the Arduino Uno, which could supply the 5V that the sensors needed.

The project was nearing its end, but we still had a number of setbacks. After having connected everything to the battery, we realized that it could not provide the power that the technology needed. To make Tosen wireless, we had to place 2 sensors in the band instead of the 3. Unfortunately those two did not offer 360 degrees coverage.

In addition to this point which has to be improved, we will also design the Tōsen more compact and less vulnerable for the next prototype. For this we are looking for more compact hardware. Unfortunately, because of the internship, we have little time to work on this at the academy. So we expect the next prototype will be there in a couple of months, but in the meantime we can draw up a plan, think out the design and a structure. The domain names are already registered; tosen.nl and Tosen.space. So... to be continued.