

Touch-responsive Storage Units:

by Alper Mutlu and Darshana Salvi

Motivation:

The motivation for this project was the immobilization that is often a part of a recuperation period in a hospital and the difficulties associated with staying in that condition for quite some time. The objective given to us was to improve upon some aspect of the hospital room setting; to make the experience of staying/working in the hospital more comfortable and convenient. Of the many things that were noticed and discussed, we decided to focus on the problem of getting stuff to the patients.

One of the difficulties faced by the nurses is that the patients cannot reach over to the bedside table to retrieve the thing they need that moment, which might be an item of personal nature. In the absence of company of friends/ family, they end up calling upon the nurses to help them fetch their stuff. This task being repetitive in nature, however trivial the task itself might seem, ends up being down-time for the nurses when there might be activities which might be more urgent and sensitive in nature for them to do. Also waiting for the nurses to come and help them for such trivial things, increases the frustration of the patients as they become more aware of their own immobilization.

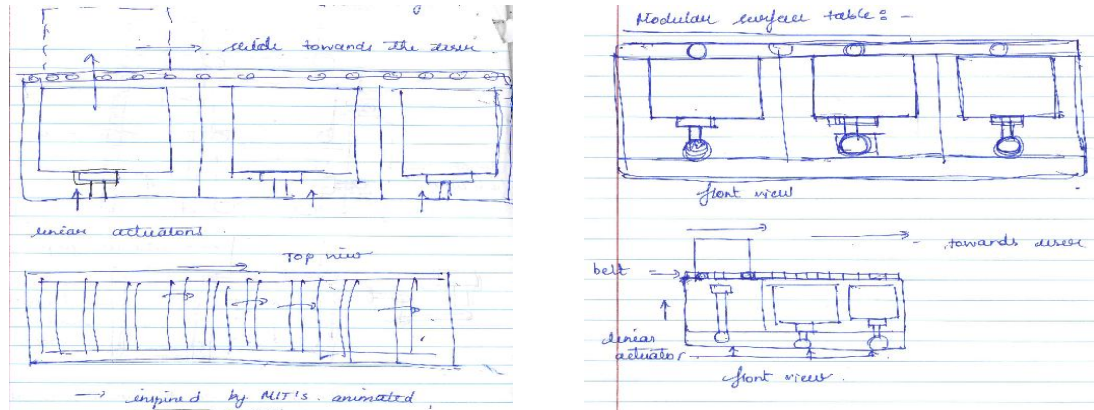


Initial Ideas:

One of the first systems we thought of was a series of boxes in the bedside storage unit with a conveyor belt-like sliding mechanism that would get activated on a press of a button, indicating the desired container.

The container would then come up and a push-out mechanism would deposit the contents onto the sliding mechanism, to deliver the contents to the patient. We thought this mechanism would be useful, but it would not have been refined enough to be used in a hospital setting where space is a major constraint, a sliding mechanism did not seem to be an efficient way of getting there.

Project 2: ECE 868



The problem was then defined to be more specific for the small daily-use items that the patients need to reach out for on a whim. This enabled us to think towards a design that was much smaller and the need was felt for them to have a mechanism that was small and efficient and not something elaborate.



Recompose: Gesture Actuated Surface-MIT Design Labs

In the next iteration of the design, we thought of making spring enforced mechanism, inspired by 'Recompose', the gesture actuated surface designed in MIT Media Labs. Since a user manipulated, continuum surface table was already in the pipeline, we decided to incorporate the storage units into the table surface. (insert the drawn picture here.)

The project consists of two storage units made of acrylic, flush mounted in the table surface. The boxes pop-up from their location to give access to the things contained, when the IR sensors receive sensory (proximity) information from the user.

Scenario:

Josh is 71 years old. He has recently had a fall in his home and fractured his leg. His life is pretty normal, except all the small things that old age brings along. And now an addition of immobility.

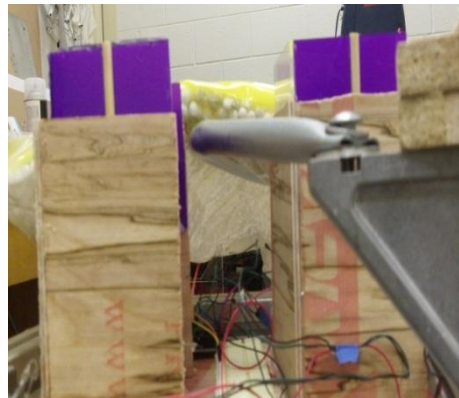
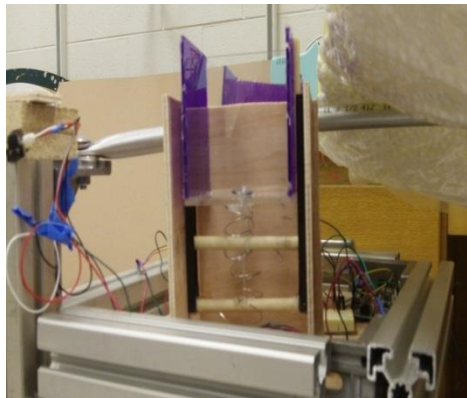
He gets irritated quite easily with the small inconveniences. He wakes up in the morning to blurry vision. He cannot find his glasses and usually gropes to the sideboard for them. This is an impulse honed over years. But now, in a hospital, things are not usually where they are and its just irritating.

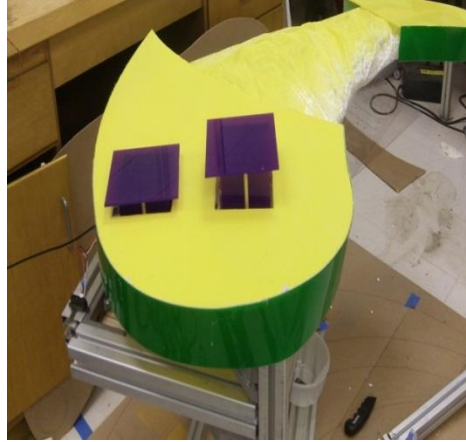
He naturally moves his hand over to the side of the table, and there they are! He found his glasses! The glasses had popped up from a convenient storage unit in the table that he now remembers. He just had to place his hand on the sensor and the convenient storage unit activated to accommodate and put away his things in the table for him.

After a while he finds that his medicines have appeared at the side. He remembers the nurse telling him that she somehow manages to program his medicines to appear at the side of the table when he needs them w/o her having to personally come over to him and nag him. He is exasperated, but also amused.

Working:

Each storage unit has a proximity input activated IR sensor associated with it. When the user desires to interact with storage unit, the user must take their hand, or any object near the IR sensor for giving proximity input to the sensor. After 3-4 seconds of this input, the arduino receives a signal for activating the motor to rotate. The boxes are held under the surface of the table by compressing a spring, by a string wound around the motor shaft. By the movement of the motor, a pulley like mechanism is created, winding and un-winding the string, to compress or release the spring.





Capacitive touch sensors with conditional time input activation will be more useful for this application and should be considered for use in the future.

The activation of the boxes can be timer based, for timely medicine delivery to the patients. Thus the nurses can store medicine in the units and set the timer, for them to get activated and give the patient access to the medicine, when it is time to take them.

Equipment used:

1. Standard servo motors: 2
2. IR sensors: 2
3. Acrylic sheets
4. Wooden planks
5. Arduino Demeuileve board
6. Springs (4 total)
7. Wooden rods to stabilize the springs.
8. Fishing spool (string to compress or release the spring)

• **Code:**

```
#include <Servo.h>
#include <Wire.h>
Servo servo1;
Servo servo2;
int count1;
int count2;

void setup()
```

Project 2: ECE 868

```
{
  Serial.begin(9600);
  servo1.attach(9);
  servo2.attach(10);
  servo1.write(180);
  servo2.write(180);
}
void loop()
{
  count1=0;
  count2=0;
  for (int i=0;i<20;i++)
  {
    float volts1 = analogRead(0)*0.0048828125;
    float dist1 = 65*pow(volts1, -1.10);
    float volts2 = analogRead(1)*0.0048828125;
    float dist2 = 65*pow(volts2, -1.10);
    if(20<dist1 && dist1<100)
    {
      count1=count1+1;
    }
    if(20<dist2 && dist2<100)
    {
      count2=count2+1;
    }
  }
  delay(100);
  Serial.println("count1=");
  Serial.print(count1);
  Serial.println("count2=");
  Serial.print(count2);

  if (count1>15)
  {
    for(int i=0;i<2;i++)
    {
      servo1.write(0);
      delay(3000);
      servo1.write(180);
    }
  }
}
```

```
    if (count2>15)
    {
    for(int i=0;i<2;i++)
    {
    servo2.write(0);
    delay(3000);
    servo2.write(180);
    }
    }
}
```

Conclusion:

The design and purpose for this storage unit system went through much iteration. While there are many ideas that can be thought of for designing a niche storage unit system, the constraints of hospital space, the sensitive nature of the environment and the cost constraint for such systems, were the major challenges.

Finding a compression spring with the right tensile strength and elasticity to work with the motors and getting enough displacement proved to be time consuming as our requirement for the displacement was quite high. We joined two springs for getting the appropriate displacement, but that invariably introduced non-linearities in the system. We would suggest appropriate caution while choosing springs.

The addition of these storage units is cost and user friendly and would prove to be a convenient addition to be considered for a hospital table.

Youtube video link:

<http://www.youtube.com/watch?v=FxYWh8js0OQ&context=C33961e5ADOEgsToPDskILJkcdaDH8Tebi egYUwWiE>