1.Introduction:

In normal cases shelf is rigid and occupies much area. If we need to place more things, the room will be much limited. Then people try to make it into rotary type so that it can save place and seems more fashion. In these cases, we have to push the shelf to make it spin. Sometimes the self contains too much things and is too heavy for us to spin. In order to save the effort, many display counters are designed into automatic one. But they spin automatically in the same speed. If we want to see some something on one side on a large display shelf ,we have to wait for a long time, especially in some Electronic Entertainment Expo or museum where there are full of people. In a word, both of these two kinds of shelves have inconvenient point. So a semi-automatic shelf is needed to be invited. That's our group's goal in project 2.

2.Background

Shelves are very common around us. It is an important tool to place things. First, let's have a look at the most common and normal one.

 (Picture 2.1)

(http://www.18mm.com/house/bookrack/18mmcom1657.jpg)

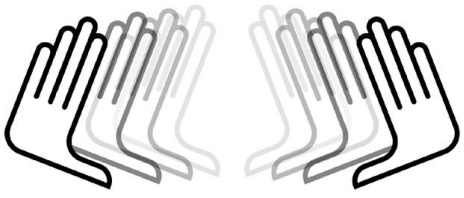
This kind of shelf is very common around us. If you have lots of things to place, it will seem very crowded. Also, it's limited in design and looks very rigid. What's more, it occupies much area.

Then if we do some improvement, it will be a rotary shelf, which picture is shown below.

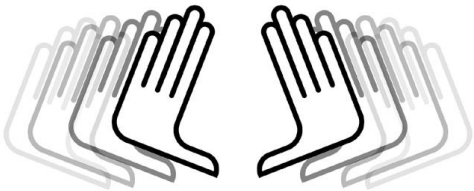
(Picture 2.2)

(http://img.china-china.biz/MImg/2008/08/07/14/ylhklxg1402040812.jpg)

Compared with the former one, it is much more flexible and beautiful. Also, it can contain more things than the traditional one. But as mentioned in introduction, if things are heavy, it will be hard to spin.

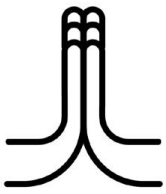


A. Zoom In



B. Zoom Out

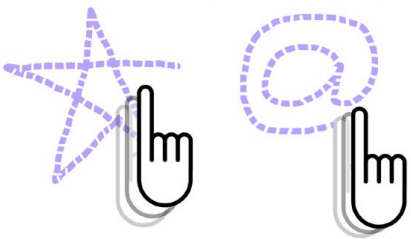
C. Frame



D. Namaste

E. Pen Up

F. Pen Down
(Thumb hidden)



G. In-the-air Drawing

Then, what can make it better? A shelf could contain more things and easy to spin. That's why we try to make a semi-auto shelf.

3.Criteria

This part shows the criteria of our shelf. The following five criteria show the advantage of our design over than their type on the market

3.1Functional

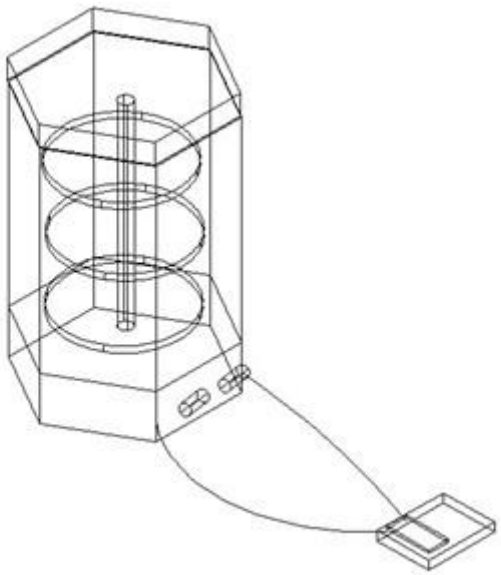
Firstly, our shelf is designed to exhibit substance, so it has the similar function as common shelves in markets. Three stories allow the shelf to exhibit enough books or products. The circle structure enables people

to see the items on the shelf from all directions. Secondly, our shelf is a semi-auto shelf that means it is clever and more automatic than ordinary products. It has two IR-electric switchers. Viewers can easily handle the semi-auto shelf with their hands. It enables them to scan all items on the shelf without moving. Since it will be located in public places such as museum, library or expo, we must consider the ability of cognizance of spectators. So our shelf must be easy to operate.

3.2Transportable

As we all know, books in the library, relics in the museum and products in the expo are always changed and moved. So our design should be easy to be transported. Specially, in some itinerant exhibition such as Shanghai Book Fair and Shanghai World Expo, the exhibition is temporary. Products will be moved soon. Shelves will also be carried. If the shelves are cumbersome, it will take more money and time to transport it. As a result, the cost will be huger, and more petrol will be wasted. So the material of the shelf should be lighter. The weight of shelf should be less than 5 kilograms. A truck with deadweight tonnage of 1 ton can convey more than 200 our semi-auto shelves.

3.3Firm



Our design is multifunctional. It can play an important role in libraries, museums and expos. At the same time, it must be responsible for exhibiting books, relics and industry products. As is known to all, a book can be a thin booklet while it can also be a thick dictionary like The oxford English Dictionary. So the range of the weight that our shelf can bear must be large. We hope that the upper bound of the load-bearing is 10kg in every storey.

3.4 Protective

When our shelves are used in exhibition centers or museums, they must be able to keep the relics or exhibits safe. However, it should also be ensured that viewers can see items on display clearly. We hope the shield of our shelf can protect the items and will not affect the view of the audiences.

3.5 Durable

When our shelf is applied in museums and libraries, the environment will be complex. Temperature, brightness or humidity will influence the operation life of the

shelf. The extra cost will influence the evaluation of our design. So we should ensure that it can be used for a long time. We hope the operation life of our design will be 10 years.

4.Final Design

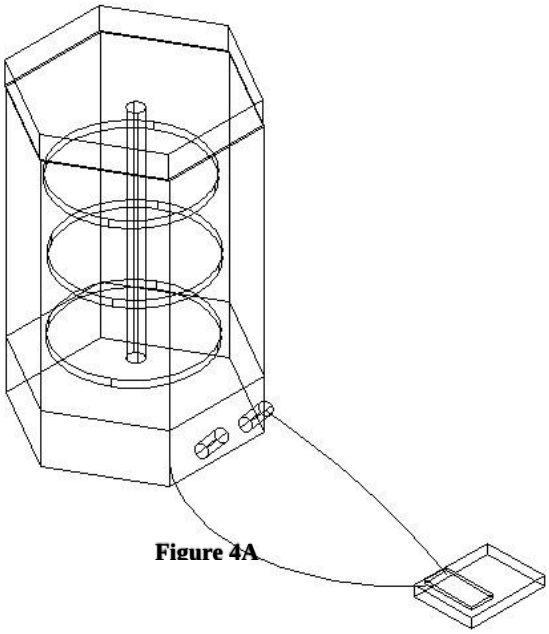


Figure 4A

Our semi-automatic shelf has a hexagon shell and a shelf with three plates where things like books can be put. The hexagon shell and plates are made by polymethyl-methacrylate (PMMA). The self-pillar itself is actually a linear incandescent lamp. The pillar is link with a DC motor at the end with a long screw to fix them. The DC motor will spin the pillar at a constant speed. Two top lights are place at the top of the shell. At the bottom of the shell, there are three switches. From the left to the right, the first switch controls the top lights and the second switch is useless (originally is used to control the AC motor to control the

shelf) and the third switch is used to control the two top lights. The IR-switches are placed on the hexagon shell and it can determine whether there is a thing before it. When the IR-switch get signal, it will make the DC motor run and rotate the pillar.

In order to control the movement of the semi-automatic shelf, specific gestures are needed.

- Put the right hand in front of the right IR-switch and don't move it , the semi-automatic self will spin in clockwise
- Put the left hand in front of the left IR-switch and don't move it , the semi-automatic self will spin in anticlockwise
- Move the hand from the left IR-switch to the right IR switch, the semi-automatic self will spin automatically
- When move the hand from the right IR-switch to the left IR switch, the semi-automatic self will stop spinning.
- The automatic spinning speed of the shelf depends on the speed of your hand's movement.

Our design can be divided in to these main parts: the outside structure, the dynamic system , lighting system and the detective system .

4.1Main parts

4.1.1 Outside structure

Outside shape of the semi-automatic shelf is a hexagon and the shelf is inside the shell. Three plates are placed at equal separation distance. The pillar of the shelf is a linear incandescent lamp.

4.1.1.1 Shell

The hexagon shell is directly taken from the automatic shelf which is totally suit for our design. It is 80 millimeters each side and each side and 70 centimeters high. The top and the bottom are made of wood. We only need to dig holes for the IR-switches.

4.1.1.2 Shelf and plates

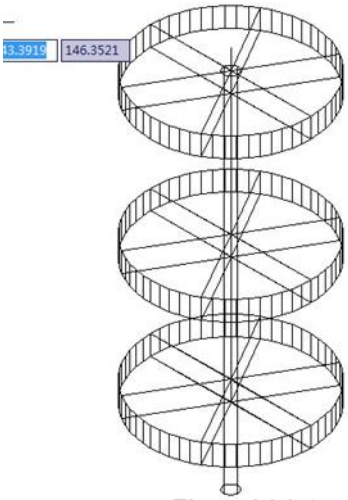


Figure 4.1.1-A

The pillar which is a linear incandescent lamp is 520 millimeters high and its radius is 15 millimeters. The self has three plates and the distance between each of them is 130 mm. The radius of each plate is 110mm. Originally, the shelf had four plates when we bought it. But the fourth plate is not convenient for us to change the dynamic system. Hence, we remove it from the bottom of the pillar.

4.1.1.3 IR switch

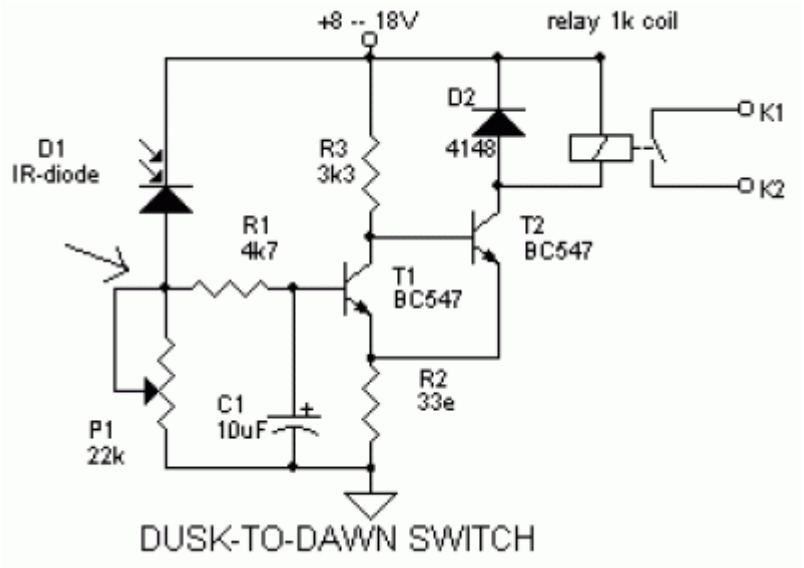
The sensors applied to automatic mobile were equipped in the semi-automatic shelf. But immediately we found it ineffective in detecting the movement. By

investigation, we figured out that these IR sensors works depends on the intensity of the light. It works according to the steps in the picture.

It is useful when we need accurate intensity of light to judge things, in automatic mobile for example. But when it comes to the circumstance when we only need to distinguish whether there is obstacle or not, it is useless.

So after consulting professor and TA, we purchased IR switch on taobao.(http://item.taobao.com/item.htm?id=4581082810) Different from IR sensors, if there is something going across the IR Switch, you can detect by reading the I/O. Instead of accurate number of the intensity of light, this way can easily tell whether we have put our hands over its detective area.

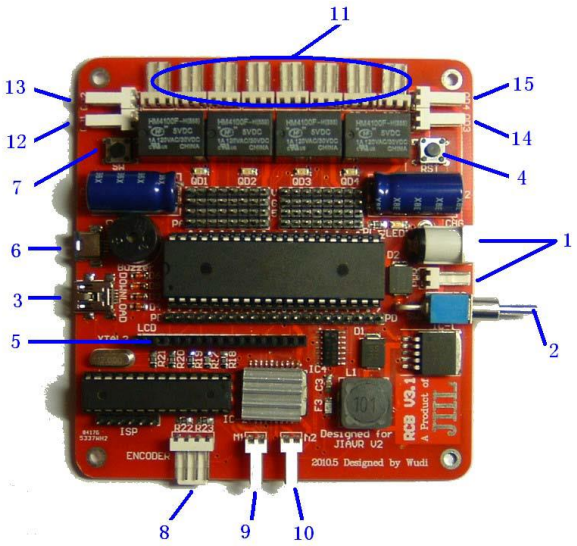
http://www.elechouse.com/elechouse/index.php?main_page=product_info&cPath=152_156&products_id=445



http://www.google.com.tw/imgres?q=IR+switch&hl=zh-CN&newwindow=1&sa=X&tbm=isch&prmd=imvnsfd&tbnid=lPpZ1JfhCE5TgM:&imgrefurl=http://www.eleccircuit.com/dusk-to-dawn-switch-by-ir-diode/&docid=14KLHAVnW5wDZM&imgurl=http://www.eleccircuit.com/wp-content/uploads/2007/08/duskdawn.thumbnail.gif&w=400&h=283&ei=0TXcTvK3GY2QiQfh7Zn7DQ&zoom=1&iact=hc&vpx=396&vpy=159&dur=1115&hovh=189&hovw=267&tx=159&ty=105&sig=112506117987894508320&page=2&tbnh=129&tbnw=182&start=14&ndsp=15&ved=1t:429,r:1,s:14&biw=1311&bih=646

4.1.1.4 RCB

The whole RCB part is undone from the automatic mobile, so it's exactly the same thing as last project, there is no need to put emphasis on it this time. And the picture below will explain everything.



4.1.2 Dynamic system

4.1.2.1 Motor

The dynamic system is made up of a DC motor which is 18 round per minute. Because the DC motors have high-quality performance and are able to precisely control the speed, they are widely used in industry(Bodson, 1993).The DC motor has a gear box to make it slow . The motor axle is 28mm with a hole which is used to let the screw penetrate it. The automatic shelf is originally driven by a AC motor which is 5 r/minute,220V~240V,50Hz and the power of it is less than 4W.

Because the RCB can only us DC motor, we removed it and changed the circuit in order to make it be able to connect with RCB.

Figure 4.1.2-A

Figure 4.1.2-B

4.1.2.2 Transmission

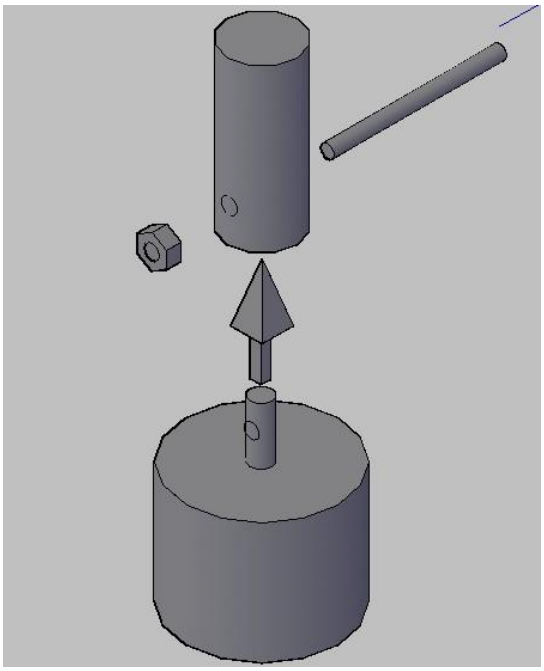


Figure 4.1.2-C

Transmission is a screw to fix the DC motor with the pillar. The screw penetrates the motor axle of the DC motor and the pillar. A nut is used to lock the screw and make the screw don't move. This is a simple but secure way to ensure the pillar rotate with the movement of the DC motor. At first, we wanted to use gear transmission . We all know one of the most common applications of gear sets is found(Kahraman,1999) in automotive transmissions .But we found it was hard for us to fix the location of the gears and the size of gear we need couldn't be found. Also, It was too expensive for us to customize a gear. Hence we decide to use the current way to drive the shelf.

4.1.3 Lighting system

4.1.3.1 Linear incandescent lamp

The linear incandescent is used as both pillar of the shelf and the lighting system. It is a common one as those used in classroom.At the bottom of it ,we dig a hole and let the crew penetrate through it .

Figure 4.1.3-A

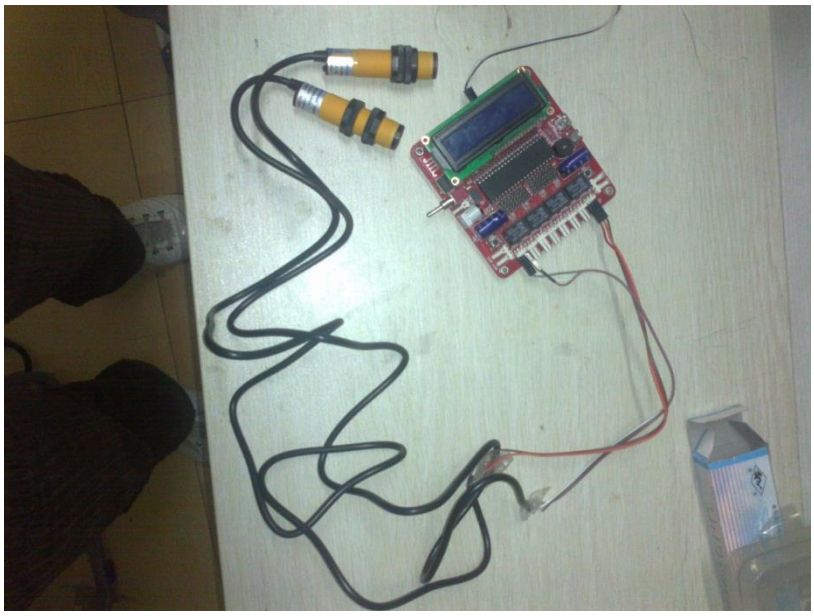
4.1.3.2 Top lights

The top lights are placed at the top of the shell. Each of them are 3 W.

Figure 4.1.3-B

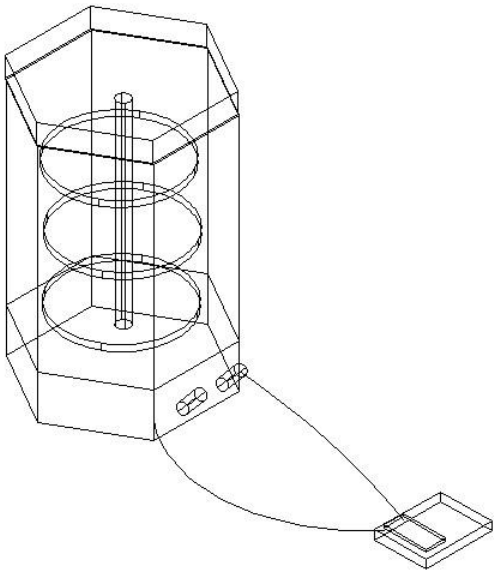
4.1.4 Detective system

The control system consists of the RCB and two IR switches.



Every IR switch is designed to stimulate one way spinning according to the program. So if you want to see the thing on your left side, just cover your hand over the left switch and it will spin automatically, and take away your hand when the thing is in your direct view.

The original location of the installation of the detective system ,which we can tell



from the picture, is at the bottom part of the shelf. When we tryed out the shelf, we founnd it is really inconvient to put your hands down nearly to ground, and using your feet was not elegant and polite. Then we wanted to put them in the middle of the shelf. But as the material for the body part is glass, we were not able to dig holes in glass, and it may

distory the beauty of the shelf. In our final design, the IR switches are placed at the top of the shelf. By placing this way, it is both good-looking and easy-using.

4.1.5 Energy saving and hommization

Compared to many existing show shelf, the design of energy saving is a big progress. As the design of our shelf is to spin when you cover your hand over the IR switch, it will not spin all the time. With this idea, the actual electrical energy used by the shelf will be much less than those never stop spinning.

Moreover, it is not only doing this way for energy saving, but also being human-centered. Using stoppingless ones may counter the problem like not having adequate time to appreciate one specific object. But when it comes to our shelf , once it is presented in front of you, you can take whatever amount of time to enjoy yourself looking at it.

http://detail.tmall.com/item.htm?id=10253660962&prt=1323062077491

4.2 Material

4.2.1 Automatic shelf

In fact, most of the material of the outside structure is taken from an automatic shelf brought from Tao Bao.

http://detail.tmall.com/item.htm?id=10253660962&prt=1322972030116&prc=1

4.2.2 Material for shelf

The shelf is made of PMMA now. PMMA is a widely used material which is the principal component of bone cements used for rapid stable fixation of implants, such as metal and plastic prosthetics placed in living bone during orthopedic procedures.(M E Jensen , A J Evans, ,J M Mathis, D F Kallmes , H J Cloft and J E Dion , n.d) In our progress report, we plan to make it in metal for weight-bearing problem instead of wood. But in fact, we find that the PMMA, a kind of a plastic, is strong enough to support the self itself and is able to support a certain things.

5.Prototype

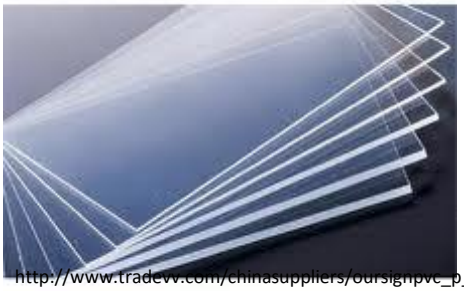
http://detail.tmall.com/item.htm?id=13117200417&prt=1323057303153&p

Ordinary products

Our design

5.1 PMMA

Our self is mainly made of PMMA which is usually called acrylic glass. In fact, it is not glass but it has no relation with glass in chemical. It is methyl methacrylate, a kind of organic. Our shelf is designed to be lighter and firmer. Moreover, it must be enable viewers to see the items on display clearly. We looked up some literature, and then found that PMMA was appropriate for us to manufacture our shelf. PMMA is as nonopaque as glass, as firm as steel and lighter than both of them. Above all, it is lighter and cheaper than glass and steal. That's why we choose it as the main raw material of our shelf.



http://www.tradevv.com/chinasuppliers/oursignpvc_p_c9e41/china-Pmma-sheets.html

http://www.injection-molding-manufacturers.com/News-144.html

http://www.tradevv.com/chinasuppliers/oursignpvc_p_c9e41/china-Pmma-sheets.html

5.2 Steel

Since our design should be firm and reliable, we then use steel screws to connect different parts of our shelf. Steel nails are used in fixing the shelf on the base. They can make our design firmer. Moreover steel screws are the most available screws in markets. You can change the parts everywhere once the shelf is broken. The working age is extended.

5.3 Rubber

We use rubber on the base of our shelf since it can improve our fraction of our shelf. Moreover, it can protect the surface of floor or table where the shelf is located.

http://detail.tmall.com/item.htm?id=13117200417&prt=1323057303153&prc=1
http://www.injection-molding-manufacturers.com/News-144.html
http://www.tradevv.com/chinasuppliers/oursignpvc_p_c9e41/china-Pmma-sheets.html

6.Evaluation

Since we have made our prototype, this part will exam whether it is satisfying.

First, we will consider function. This is the most important part since our goal is to add new function to shelf. Our prototype could spin based on user's gesture. The speed can be determined by your speed of hand movement is really a great thing. We all think we have made great improvement on the original shelf. However, there are still many assumptions we cannot put into application because the limit of time and energy. This will be mentioned in the recommendations.

Second part is about firm. The material of our prototype is PMMA. This material is relatively solid among plastic. Its remarkable stability makes our prototype qualified for both stuff placing and display. It can carry more things than normal shelf. But it has its limit which means it is for civil use only, if things are too heavy it will be out of shape.

Then we will consider appearance. The plate is made of PMMA which is a kind of transparent material thus making the prototype really beautiful. What's more, the axis is made by a tube which can emit light. These things make our prototype really attractive. Also, there are shortcomings. Since we didn't have experience of reorganization, during the time of dismantlement, irreversible damages were done to it. So some place of it might seem coarse.

At last, we will talk about whether it is easy to transport. Our prototype is really a light thing to carry. Our group member tried to lift it by one hand and succeeded. It will save much time and energy to move it.

7.Recommendations

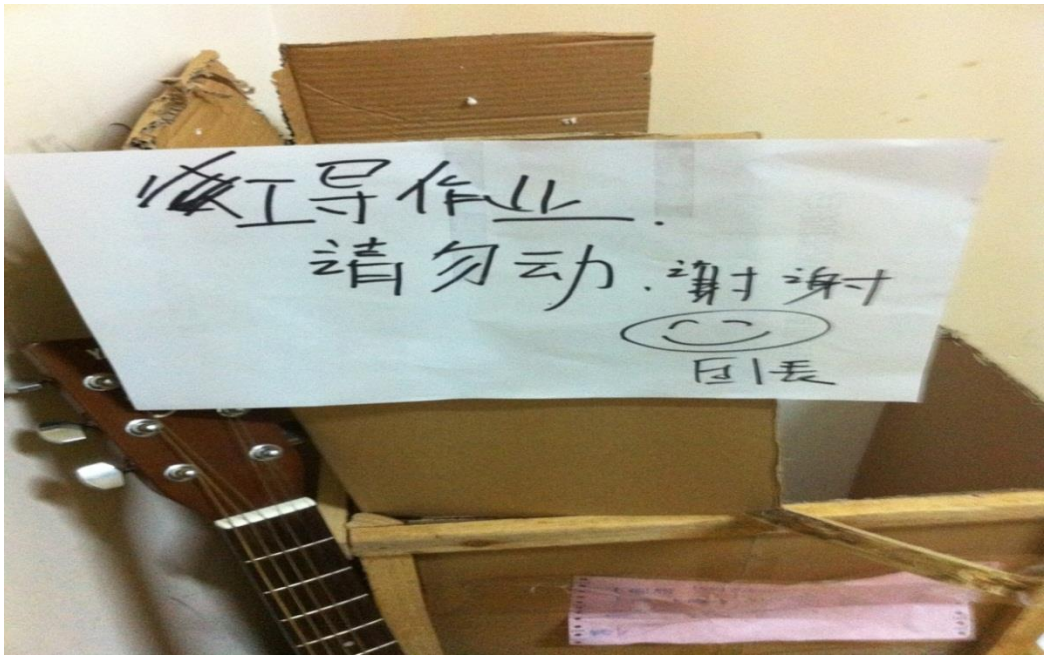
Since we only have a month and half to finish our work. Shortages are inevitable. In this part, we will show our experience and our assumptions which we didn't put into practice.

In our original design, the shelf is covered by a curtain. The curtain can draw by a motor according user's gesture. This task was uncompleted since now. But we really think it is a good design and strongly recommend this modification to the shelf.

About motor, we chose DC motor to drive the device. It was because our RCB does not have a program to drive stepper motor. "Stepper motors were designed to provide precise positioning control within an integer number of steps (e.g., 200 steps for a resolution of 1.8") without using sensors."(M. Zribi and J. Chiasson, 1991) Based on our previous study, we all think stepper motor will do better in position control. So if given another chance, we will exam this idea in our work.

Then, we strongly suggest readers to have a detailed plan before start to work. In our experience, we wasted lots of money on unnecessary things. For example, we bought a heavy long iron axis which is totally unsuitable for our bearing. That giant thing cost us 120 yuan. This kind of thing is avoidable if we make a good plan before.

The last thing is to tidy your tools and materials whenever you finish work. Due to our carelessness, we lost many useful tools and caused much trouble. We need to borrow tools from other group to complete our work. After learning this lesson, we put a piece of paper on our box.



(Picture 7.1)

We wrote “This is our team’s VG100 project, please don’t use.” This was really useful.

8.Conclusion

Project 2 is the first completely independent teamwork in our campus life. We chose the project that met the requirement of society. It can be used as a display counter in market, showcase in museum or the moveable wardrobe in home. Shelf will be operated according to your own mind. We Sketched design, purchased appropriate material assembled prototype and compile the program with our own hands. Reflecting humanization is our target, so we will modify our semi-automatic shelf step by step. Moreover, presentation and demonstration will be the most important part in our project. Since we have persuaded ourselves that the shelf meet the social demand, we must convince more people by final presentation and demonstration. In one word, humanization is the resource of our thoughts.

First we wanted to make all things we needed by our own. But not long after that, we found it was impossible to deal with all the problems both in software and hardware in such a short time. Then we made the decision: grabbing the essence, the software and the innovation, and giving up those not so important, like the outside structure.

Combining all the materials we had to achieve what we had in mind was not as easy as we thought it would be. Something seems can not be fit together. After all the adjustments and tests, we built the shelf which can spin according to the gestures done by other people.

The shelf is designed to show things to others without touching any of them. To some extent, the operation is like using iPhone. You slip your hand over the IR switches, and things in the shelf will move according to your mind.

9.Reference

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Jochen Triesch & Christoph von der Malsburg (n.d)
A Gesture Interface for Human-Robot-Interaction

M E Jensen , **A J Evans**, ,**J M Mathis**, **D F Kallmes** , H J Cloft and J E Dion (n.d)

Percutaneous polymethylmethacrylate vertebroplasty in the treatment of osteoporotic vertebral body compression fractures: technical aspects.

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Linearization. *IEEE TRANSACTIONS ON AUTOMATIC CONTROL,36*(5),P.620
Retrieved from
http://ieeexplore.ieee.org/stamp/stamp.jsp?tp=&arnumber=76368

APPENDIX:

Appendix for current shelf in department:

Appendix for automatic/no automatic shelf in market:

http://item.taobao.com/item.htm?id=10253660962&ad_id=&am_id=&cm_id=&pm_id=#

http://cn.made-in-china.com/showroom/fangsiyuan

http://item.taobao.com/item.htm?id=7312817143

APPENDIX for material:

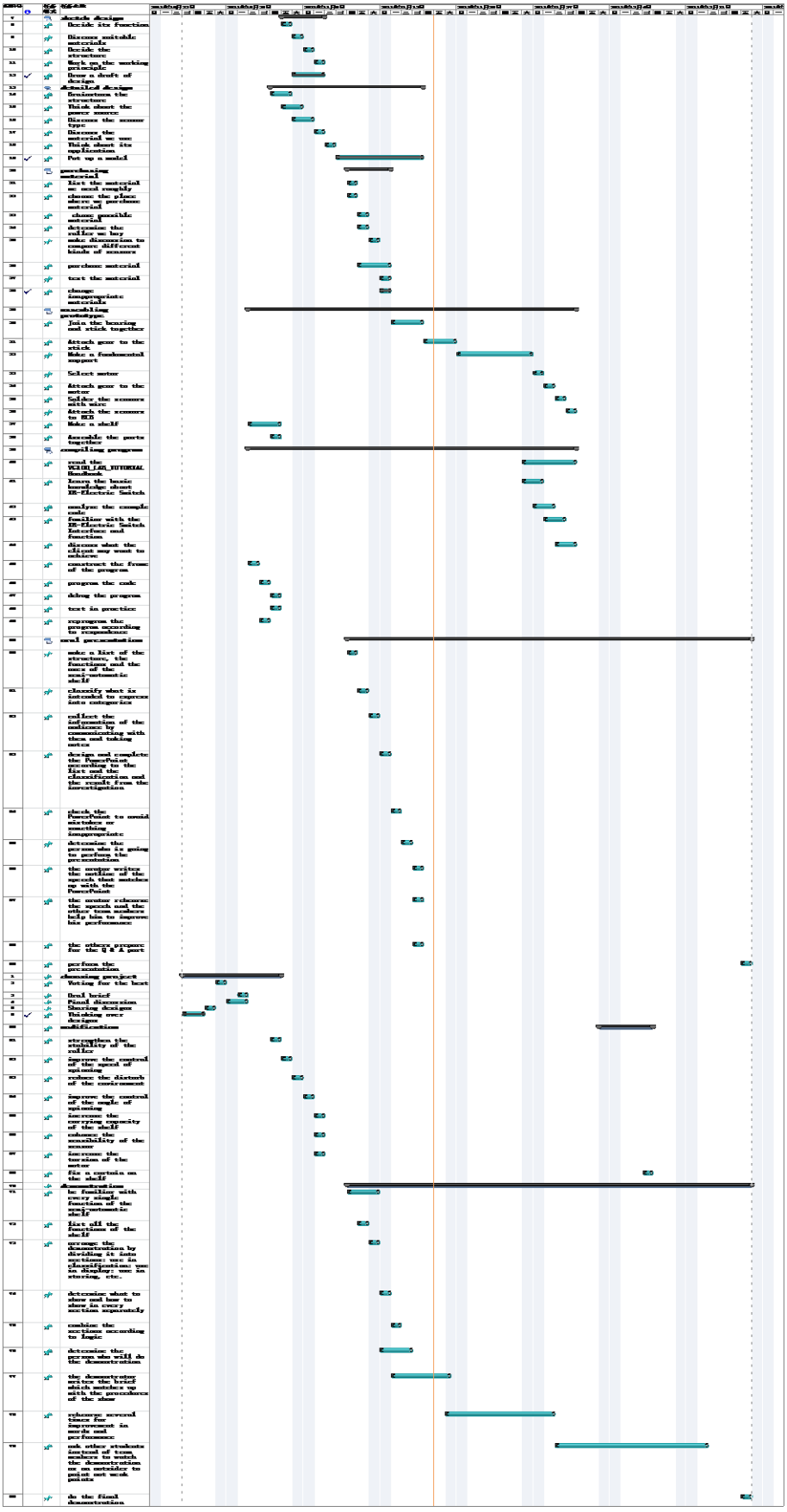
Motor

http://item.taobao.com/item.htm?id=13209415113

PMMA

http://item.taobao.com/item.htm?id=10401130522&ad_id=&am_id=&cm_id=&pm_id=

APPENDIX for Gantt Chart:



APPENDIX more pictures of prototype:

APPENDIX code

代码 1：

```
//IO sample code

#include <JIrobot++.h>

input sensor1(0);          //declear an input & port 0
input sensor2(7);          //declear an output & port 1int determine(void);
int main(void)                    //Main Function
 {wait (3);
       while(1)
             {
```

```
            if (sensor1.get())
                {go(250,0);
            waitms(1);}


             if (sensor2.get())
                {go(-250,0);
            waitms(1);}




        }
}
```

代码 1.1（错）

```
#include <JIrobot++.h>

input sensor1(0);          //declear an input & port 0
input sensor2(7);          //declear an output & port 1int determine(void);
int main(void)                  //Main Function
 {wait (3);
      while(1)
           {
            if (!sensor1.get())
                {go(250,0);
            waitms(50);

            print(0,0,sensor1.get());      print(6,0,sensor2.get()); }


             else if (!sensor2.get())
                {go(0,0);
            waitms(1);
            print(0,0,sensor1.get());      print(6,0,sensor2.get()); }
```

```
            }
}
```

代码 1.2

```
#include <JIrobot++.h>

input sensor1(0);          //declear an input & port 0
input sensor2(7);
void stop()      ;//declear an output & port 1int determine(void);
int main(void)                    //Main Function
 {wait (3);
       while(1)
            {
                 if (!sensor1.get())
                       {go(250,0);
                 waitms(30);
                 stop();
                 print(0,0,sensor1.get());       print(6,0,sensor2.get()); }


                  else if (!sensor2.get())
                       {go(-250,0);
                 waitms(30);
                 stop();
                 print(0,0,sensor1.get());       print(6,0,sensor2.get()); }




            }
}


 void stop()     {go(0,0);}
```

代码 2：

```
 #include <JIrobot++.h>

int main(void)                    //Main Function
```

```
{
    mstick[0]=0;   //a difference of 500ms is set up between mstick 0,1 and 1,2
    mstick[1]=500;
    mstick[2]=1000;
    while(1)
        {
            print(0,0,mstick[0]);    //from LCD we can find that mstick counts
automatically as the time being
            print(6,0,mstick[1]);
            print(12,0,mstick[2]);
            waitms(200);
            cls();
            if (button())
            {
            mstick[0]=0;
            mstick[1]=0;
            mstick[2]=0;    //reset all mstick if button is pressed
            }
        }
}
```

代码 3 （slide move）

```
#include <JIrobot++.h>

input sensor1(0);          //declear an input & port 0
input sensor2(7);




void print();
void stop() ;    //declear an output & port 1int determine(void);
int main(void)                    //Main Function
 {wait (3);
    while(1)
        { print();
            if (!sensor1.get())
                {

              mstick[0]=0;

              while (mstick[0]<500)
```

```
                {    print();
                 if    (!sensor2.get())

                 {go(250,0);
                wait(2);
                stop();}}

                }


                if (!sensor2.get())
                      {

                 mstick[0]=0;

                 while (mstick[0]<500)

                 {    print();
                 if    (!sensor1.get())

                 {go(250,0);
                wait(2);
                stop();}}

                }









            }
}


void print(){print(0,0,sensor1.get());    print(6,0,sensor2.get()); }
void stop()      {go(0,0);}
```

代码（实现测速）

```
#include <JIrobot++.h>

input sensor1(0);          //declear an input & port 0
```

```
input sensor2(7);

int speed;


void print();
void stop() ;    //declear an output & port 1int determine(void);
int main(void)                    //Main Function
 {wait (3);
       while(1)
            { print();
                 if (!sensor1.get())
                       {

                   mstick[0]=0;

                   while (mstick[0]<500)

                   {    print();
                   if    (!sensor2.get())

                   {print();
                   speed=mstick[0];
                   go(5000/speed,0);
                  wait(2);
                  stop();}}

                  }


                  if (!sensor2.get())
                       {

                   mstick[0]=0;

                   while (mstick[0]<500)

                   {    print();
                   if    (!sensor1.get())

                   {print();
                   speed=mstick[0];
                   go(5000/speed,0);
                  wait(2);
```

```
                    stop();}}

                    }









            }
     }


    void print(){print(0,0,sensor1.get());    print(6,0,sensor2.get());
print(0,2,"speed");print(6,2,speed);}
    void stop()      {go(0,0);}

    代码（1+2 同时实现）
    #include <JIrobot++.h>

    input sensor1(0);          //declear an input & port 0
    input sensor2(7);

    int speed;


    void print();
    void stop() ;    //declear an output & port 1int determine(void);
    int main(void)                    //Main Function
     {wait (3);
          while(1)
               { print();
                    if (!sensor1.get())
                         {

                      mstick[0]=0;

                      while (mstick[0]<500)

                      {    print();
                      if    (!sensor2.get())

                      {print();
                      speed=mstick[0];
```

```
                    go(5000/speed,0);
                   wait(2);
                   stop();}}

                      if (!sensor1.get())
                    {go(250,0);waitms(500);stop();}
                      mstick[0]=0;

                   }


                   if (!sensor2.get())
                         {

                    mstick[0]=0;

                    while (mstick[0]<500)

                    {    print();
                    if    (!sensor1.get())

                    {print();
                    speed=mstick[0];
                    go(-5000/speed,0);
                   wait(2);
                   stop();}}

                   }
                   if (!sensor2.get())
                    {go(-250,0);waitms(500);stop();}


              mstick[0]=0;

            }
      }


    void print(){print(0,0,sensor1.get());    print(6,0,sensor2.get());
print(0,2,"speed");print(6,2,speed);}
    void stop()      {go(0,0);}
```

代码 FINAL

```
#include <JIrobot++.h>

input sensor1(0);           //declear an input & port 0
input sensor2(7);

int speed;


void print();
void stop() ;    //declear an output & port 1int determine(void);
int main(void)                    //Main Function
 {wait (3);
       while(1)
            {waitms(50);
            cls();         print();
                  if (!sensor1.get())
                        {

                    mstick[0]=0;
                    mstick[1]=0;

                    while (mstick[0]<500)

                    { cls();     print();
                    if    (!sensor2.get())

                    {cls();    print();
                    speed=mstick[0];
                    go(5000/speed,0);
                   wait(2);
                   stop();}}

                      if (!sensor1.get())
                    {go(250,0);waitms(500);stop();}
                      mstick[0]=0;

                   }


                   if (!sensor2.get())
                         {

                    mstick[0]=0;
```

```
                    while (mstick[0]<500)

                    { cls();     print();
                    if    (!sensor1.get())

                    { cls();   print();
                    speed=mstick[0];      //PAY ATTENTION FOT THESE PLACE,IF IT IS IN
FOR,IT WILL BE A MISTAKE
                    for(1;;)
                    {cls();    print(9,2,"hi,I`m here");

                    go(-5000/speed,0);

                    if(!sensor1.get()){cls();break;}

                   }
                   }

                   }
                   if (!sensor2.get())
                    {go(-250,0);waitms(500);stop();}
                   }

                 mstick[0]=0;
                  mstick[1]=0;
                    cls();
               }
     }


    void print(){print(0,0,sensor1.get());    print(6,0,sensor2.get());
print(0,2,"speed");print(6,2,speed);}
    void stop()      {go(0,0);}
```