Auto Shopping Guide System

SFU ENSC 440/305 W

Easy Way Inc.

Apr 16th, 2014

EASY WAY

Project Group

- Joseph Lu – CEO
- James Lin – COO
- Enzo Guo – CTO
- Tao Xiong – CFO
- Jacqueline Li – VP

EASY WAY

Road Map

- Introduction
- Existing Automated Guided Vehicle
- Our Design
- System Overview
- UI & Database *(flaws, future work & individual duties included)*
- Firmware *(flaws, future work & individual duties included)*
- Hardware *(flaws, future work & individual duties included)*
- Scheduling
- Financial Status
- Conclusion
- Acknowledgement
- Reference
- Questions

3

EASY WAY

Introduction

- Motivation
  — Idea enlightened based on shopping experience

  — Finding items could be frustrating for non-natives

  — Designing a system that helps customers quickly locate items

  — Benefits to consumers could be the key to business success

- Existing AGV (Automated Guided Vehicle)
  — AGV for carrying explosives   — AGV for picking load from rack

EASY WAY

Our Design

- Automated System – Integration of Hardware and Software
  — User Friendly Interface
  — Intelligent Operation
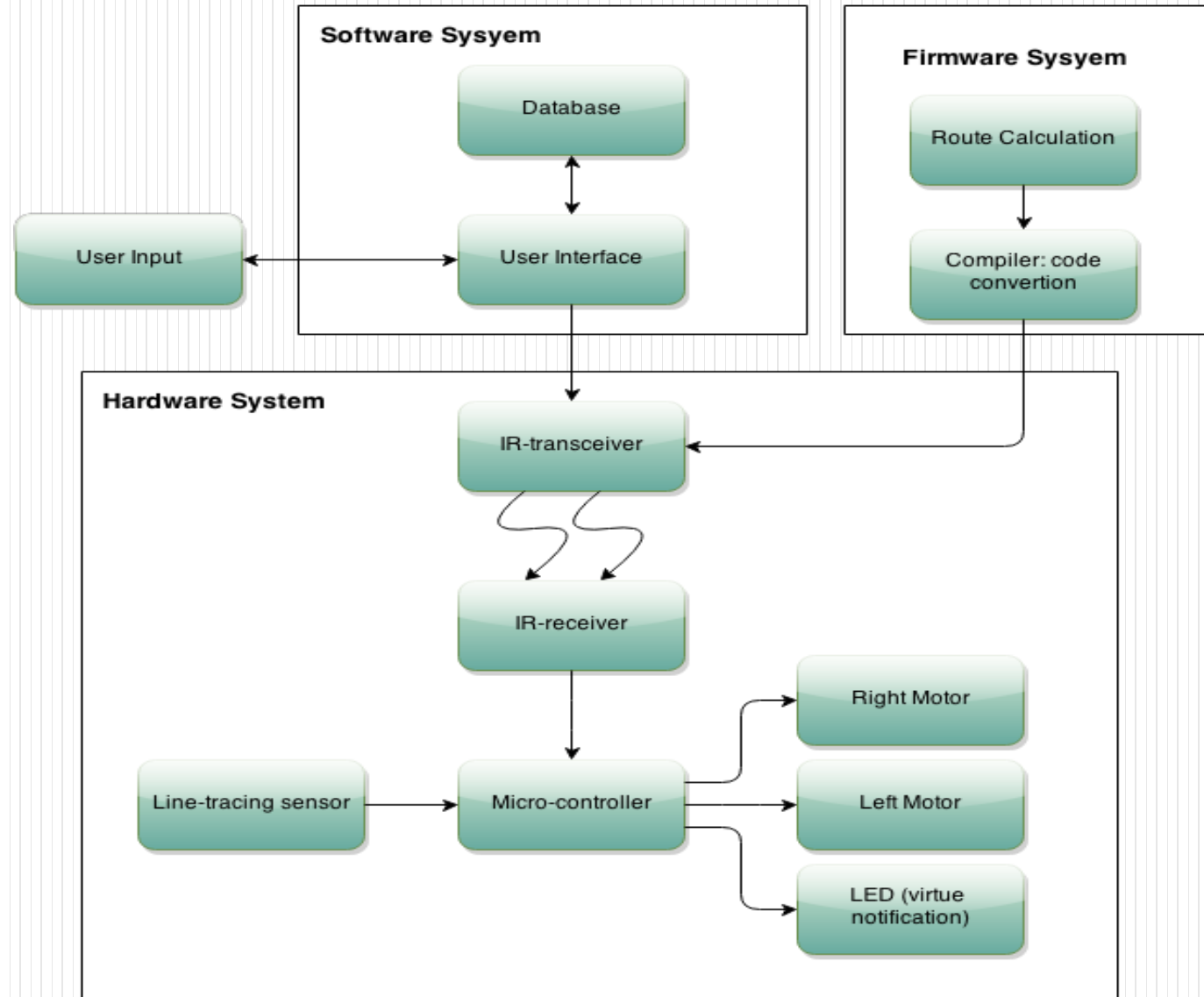 — Potential Future Development

User input

Mobile User Interface

Auto Shopping Guide(ASG)

(ASG)

Guilding in Process

EASY WAY

System Overview

User Interface

User Interface:

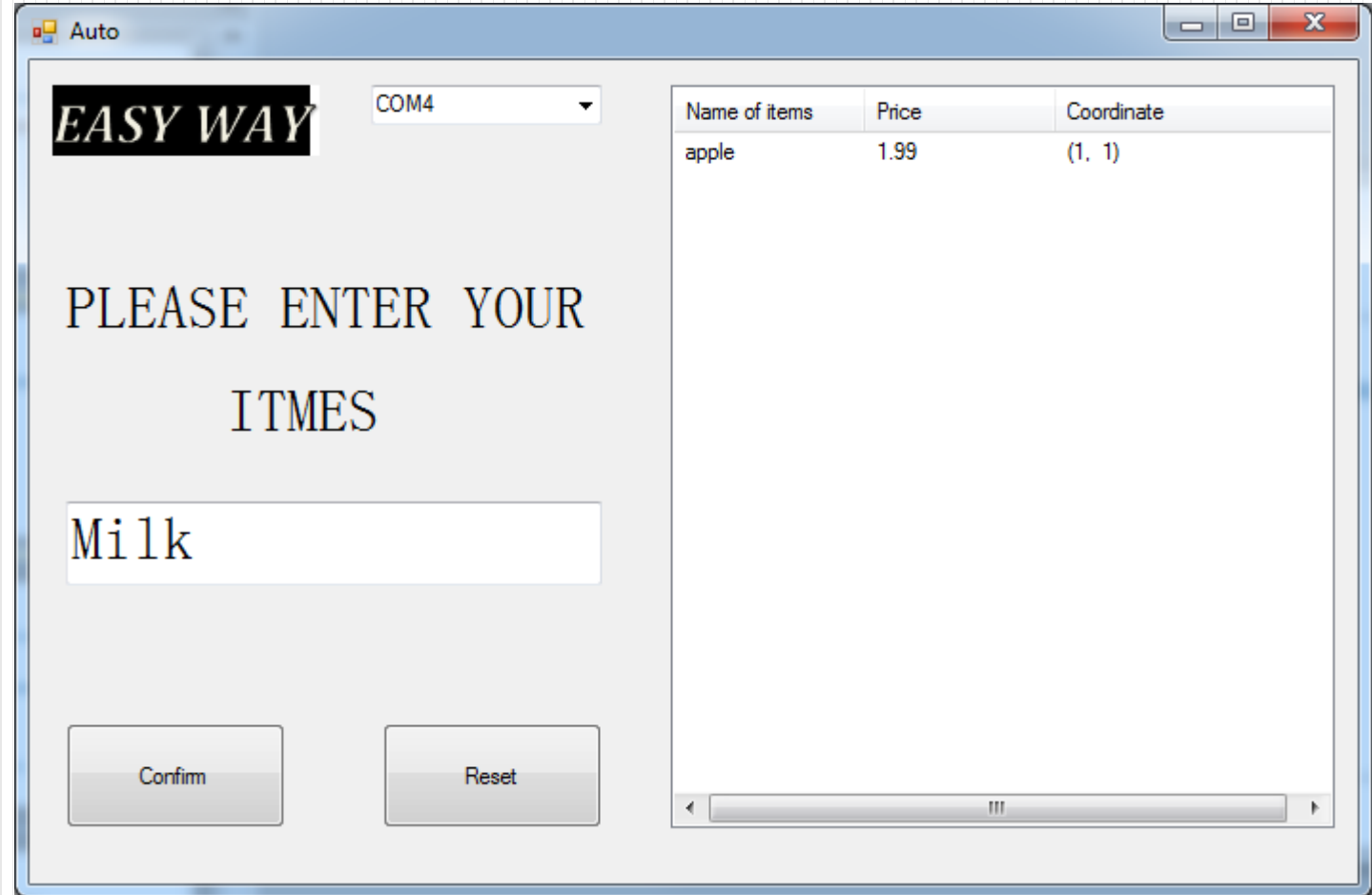- **UI** : an operation and control of the machine (user and the machine)

- **Text-editing box**: type an item
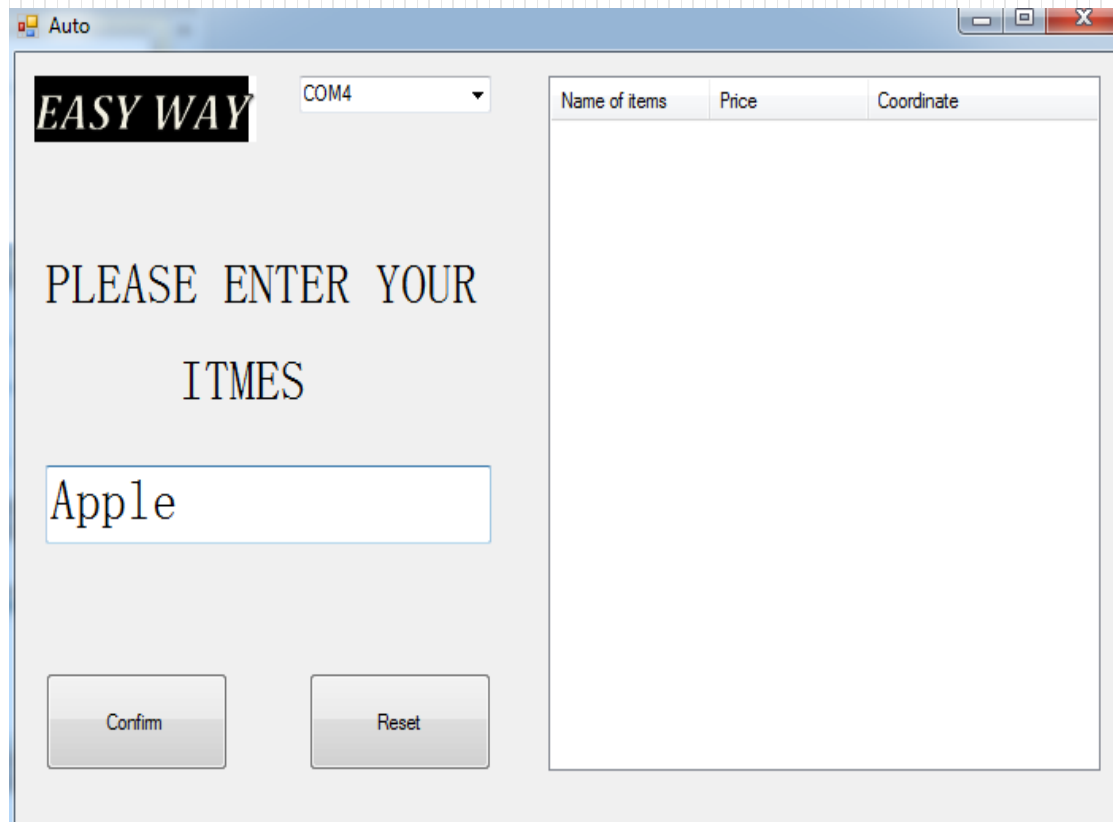
User Interface:

- **Confirm button**:

  a. Checking items if can be found from the database - Yes/ No

  b. List the item on the right side of the UI

  c. Send data out

User Interface:

- **Confirm button**:

  a. Checking items if can be found from the database - Yes/ No

  b. List the item on the right side of the UI
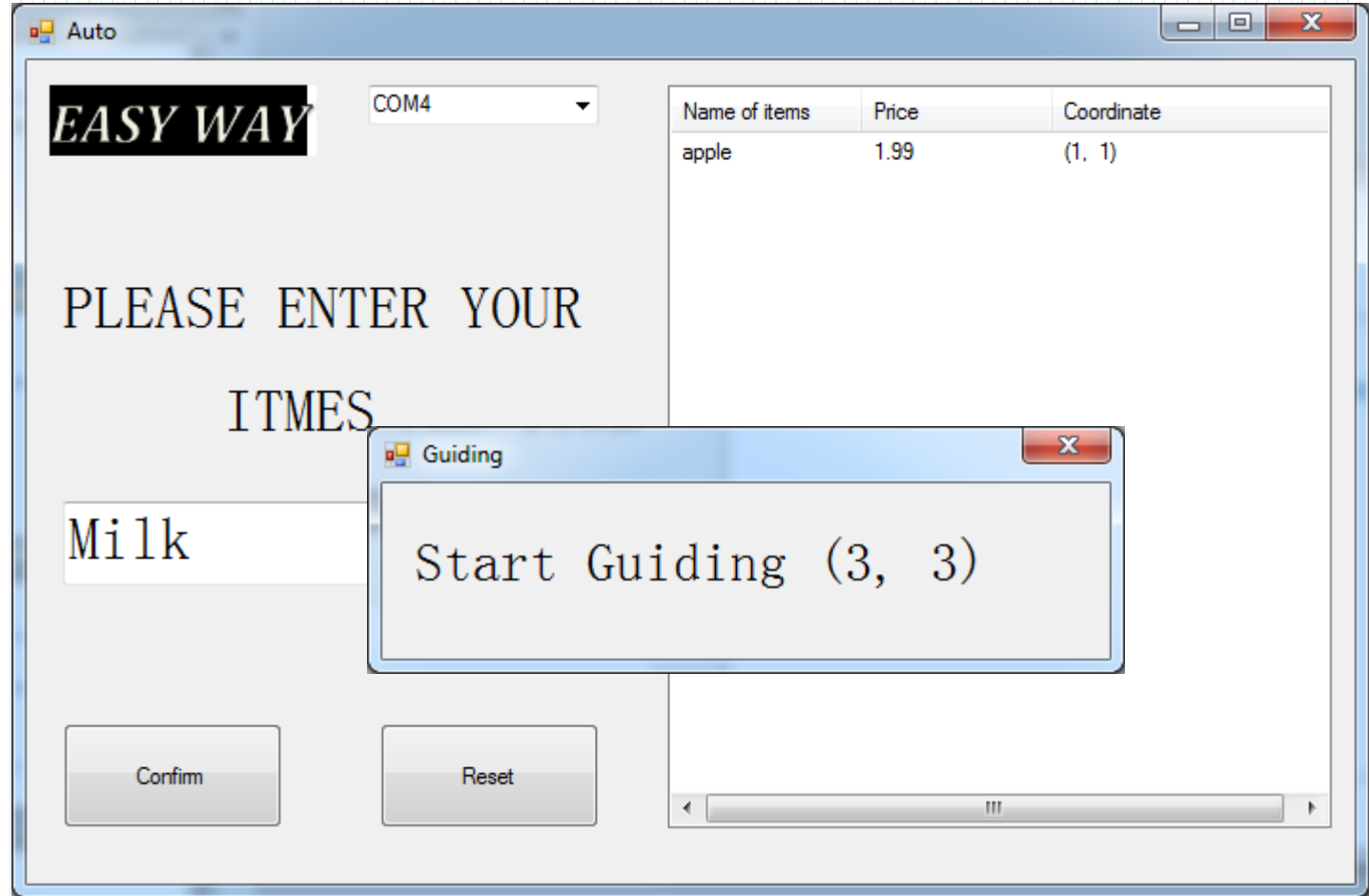
  c. Send data out

User Interface:
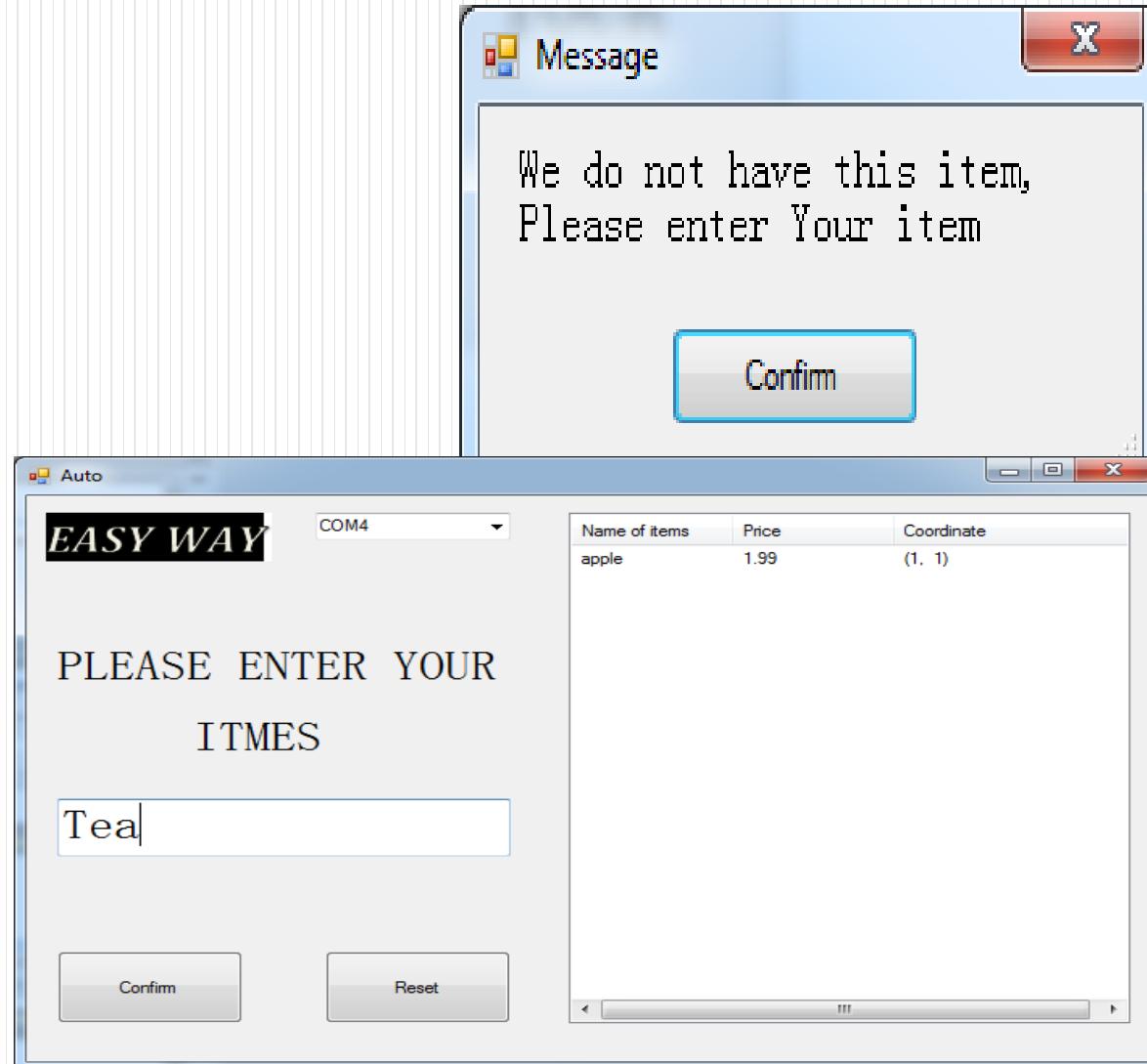
- **Confirm button**:

  a. Checking items if can be
     found from the database
     - Yes/ No

  b. List the item on the right
     side of the UI

  c. Send data out

- **User operation section**:
  history

User Interface:
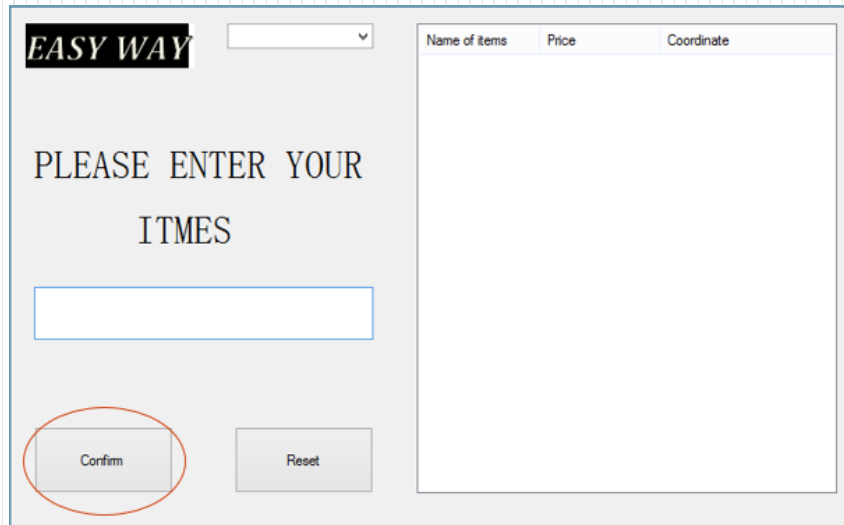
- **COM: USB PORT**

- **User operation section:**

  history

- **Reset Button:**

- reset the UI. Clear the history
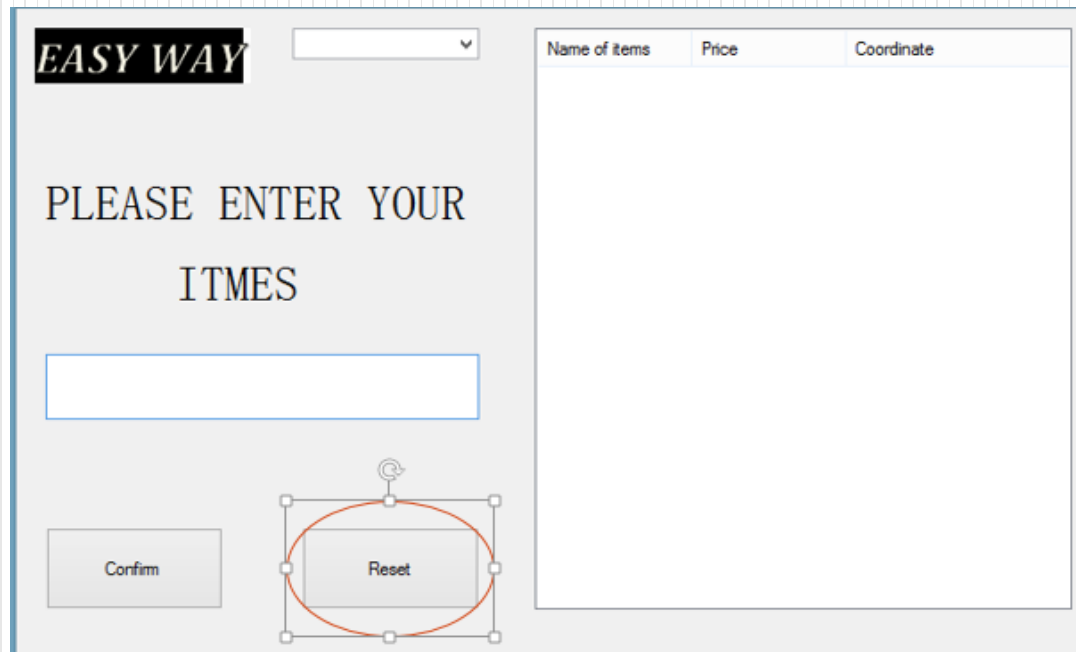
Elements in UI

- "Confirm" Button


```csharp
private void buttonConfirm_Click(object sender, EventArgs e)
{
    StartSearch();
}
```

— Confirm the inputted item names

— C# code for button handling

— "Return" press has the same function

Elements in UI

- "Reset" Button


```csharp
private void buttonReset_Click(object sender, EventArgs e)
{
    TextBoxItemsName.Clear();
    listViewInfo.Items.Clear();

    coor_last.x = 0;
    coor_last.y = 0;

    coor_cur.x = 0;
    coor_cur.y = 0;
}
```

— Clear the displayed list. Clear coordinates. Ready for re—input

— C# code for button handling

14

Elements in UI

- Display List and Database

Name of items	Price	Coordinate
apple	1.99	(1, 1)

```
struct SearchItmes
{
    public string itemsName;      // Name
    public double price;          // Price
    public Coordinate coor;       // Coordinates
};

SearchItmes[] search_base = new SearchItmes[7];


search_base[0] = InitSearchItmesTest("apple", 1.99, 1, 1);
search_base[1] = InitSearchItmesTest("banana", 0.99, 1, 3);
search_base[2] = InitSearchItmesTest("noodle", 3, 3, 1);
search_base[3] = InitSearchItmesTest("milk", 4.99, 3, 3);
search_base[4] = InitSearchItmesTest("bread", 3.99, 2, 2);
search_base[5] = InitSearchItmesTest("Pizza", 10, 0, 3);
search_base[6] = InitSearchItmesTest("check out", 0, 0, 0);
```
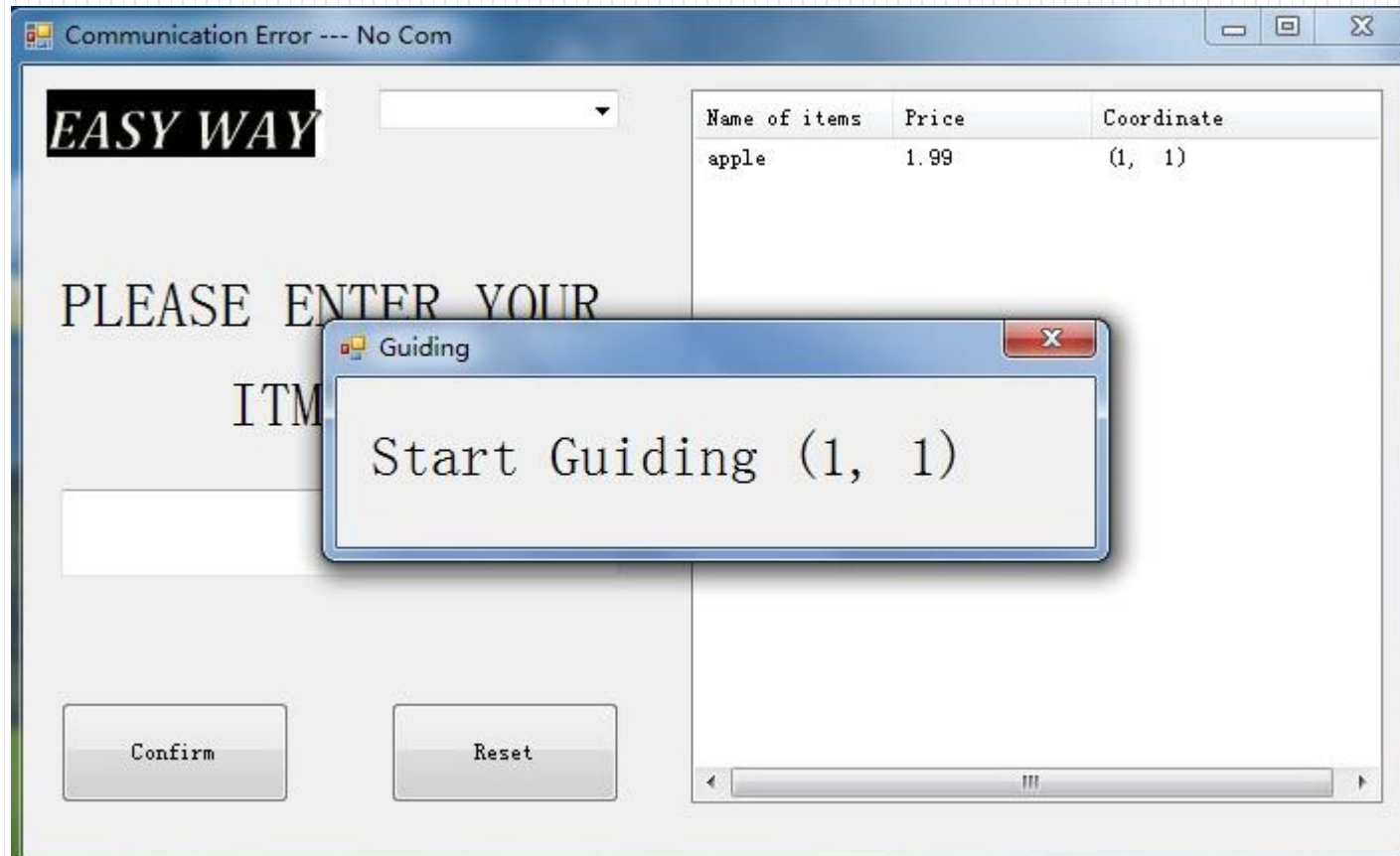
EASY WAY

15

Future Development
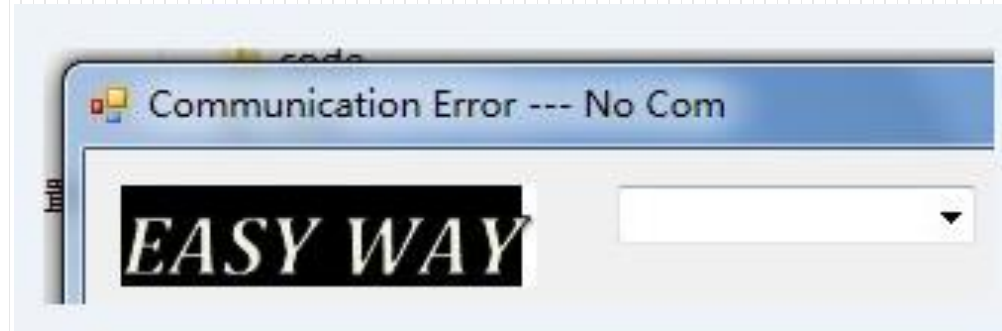
- "Start Guiding" prompt should not have "close" option

Future Development

- Reset buttom in the UI

- No COM box displayed in UI
1. Not needed for users

- Database
1. Better create a larger database by MS SQL for more information
- Confirmation of "Check Out" will disable further inputting items

Firmware

1. Route calculation algorithm

2. 'Lane departure detection' method

EASY WAY

Route calculation

1. Process the data received from the UI

2. Calculation route and movement method

   -- Go straight

   -- Turn right or left.

   -- Record the car current position

EASY WAY

19

'Lane departure detection'

1. Check if the car is moving on the desired black lane, regulate the route.

2. When the car tries to depart from the lane, the system will regulate the route, so the car would come back to the desired lane.

3. Identify if the car reach the destination.

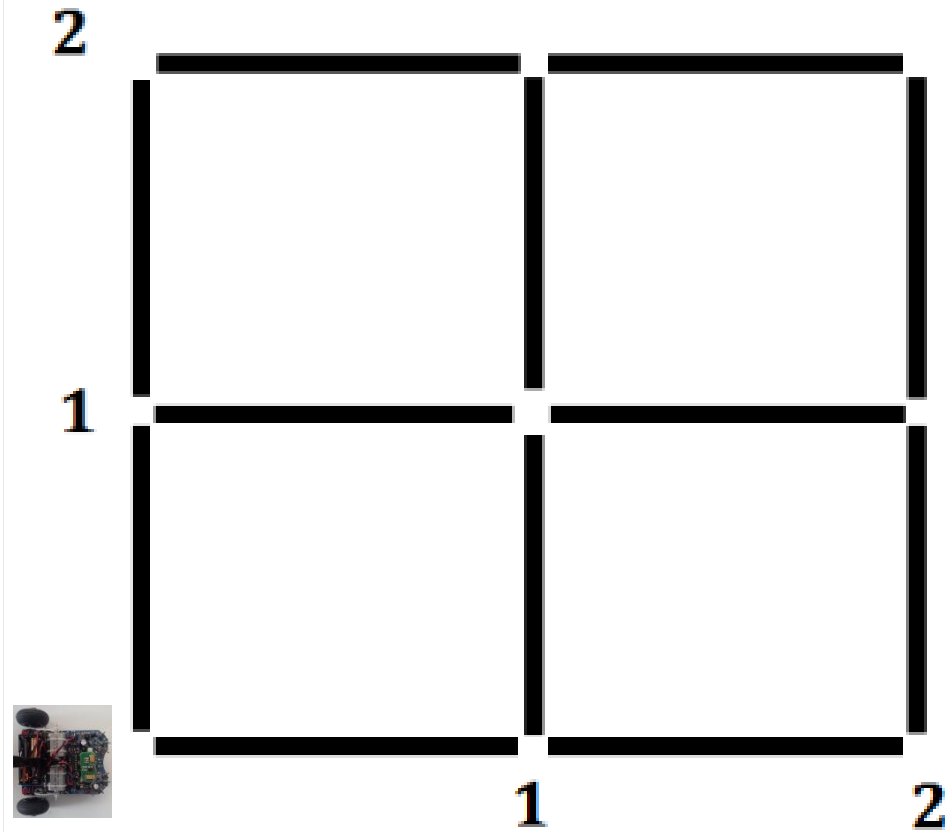EASY WAY

'Lane departure detection'

```c
if((In_Value[0]>=L_Max)&&(In_Value[1]>=R_Max))//Not on black lane
{
    Temp_Position = 0x10;
}

else if(In_Value[0]>=L_Max)//left detect higher, depart from left
{
    Temp_Position = -2;
}
else if(In_Value[1]>=R_Max)//right detect higher, depart from right
{
    Temp_Position = 2;
}
else
{
    Temp_Position = 0;//on black lane
}

if(Temp_Position==0x10)//car is not on the black lane
{
    if(Swerve_Flag&BIT7)
    {
        if(Swerve_Flag&BIT1)
            Line_Horizontal++;
        else if(Swerve_Flag&BIT2)
            Line_Horizontal--;
        else if(Swerve_Flag&BIT3)
            Line_Vertical++;
        else if(Swerve_Flag&BIT4)
            Line_Vertical--;
        Swerve_Flag &= ~BIT7;
    }
```
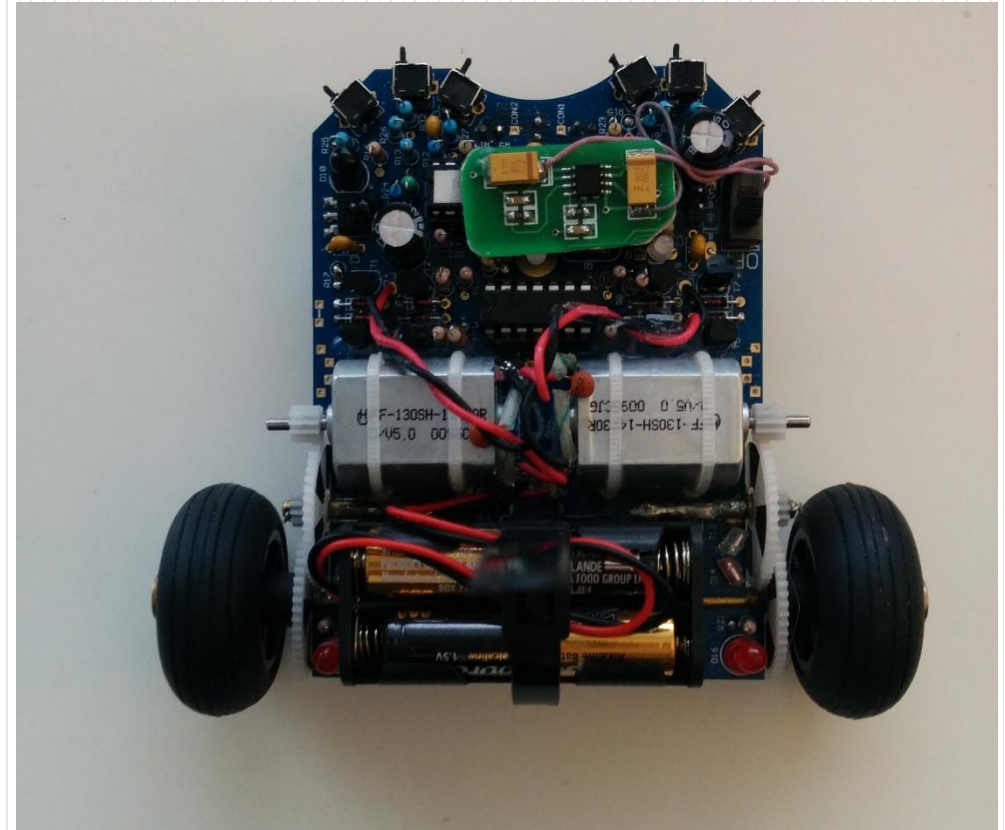
EASY WAY

Quick Example

Flaws and Future Development

1. Make 'U' turn (calculating algorithm).

2. Need to create a feedback system, so that the UI side can update the car status, and adjust when needed.

EASY WAY

23

Hardware Overview

- Based on Arexx Asuro robotic car
- Modified voltage stabilization circuit and infrared emitter circuit
- Contains 5 major parts
  1. ATmega 8 microcontroller
  2. 2 motors for wheels
  3. Line tracing sensor
  4. Voltage stabilization circuit
  5. Infrared emitter

EASY WAY

Hardware Overview

- ATmega 8 Microcontroller
1. Manufactured by ATmel
2. 8-bit AVR processor
3. Max. frequency 16 MHz
4. RAM: 512 Kb
5. ROM: 8Kb (1 Kb is reserved for boot loader)
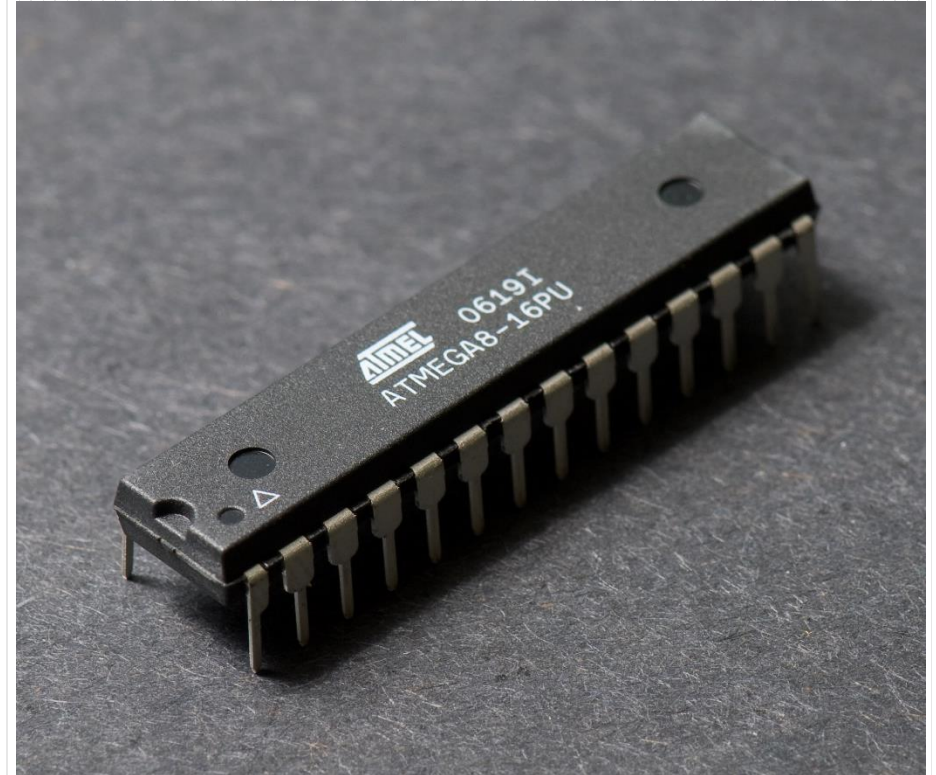
EASY WAY

Hardware Overview

- 2 Motors for wheels
1. 2 motors are controlled by micro controller separately
2. Make turns by applying different speeds to motors
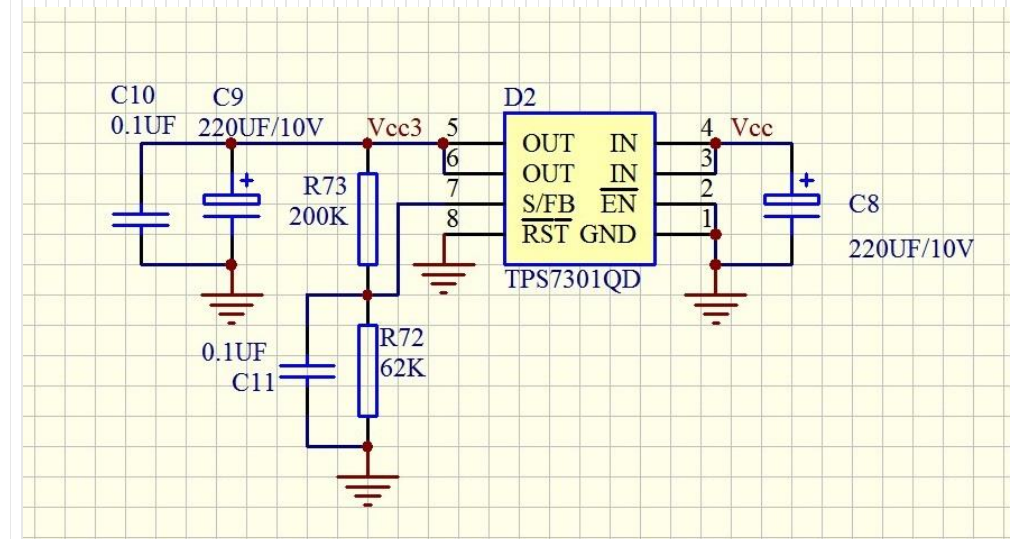3. Less turning radius

- Line tracing sensor
1. Contain one LED and two photodiodes
2. Photodiode are sensitive to light

EASY WAY

Hardware Overview

- Voltage stabilization circuit

1. To eliminate the voltage drop issue of battery

2. TPS7031 low dropout voltage regulator

3. Constant output of 5V, 500 mA

EASY WAY

Hardware Overview

- Modified Infrared emitter

1. The transmission distance for USB infrared emitter is less than half meter

2. By connecting the USB infrared emitter to an external emitter, the transmission distance is increased to 10 meter (Tested)

EASY WAY

Flaws and Future Improvements

- Limited processor
  1. All the pins of processor are used, we are not able to add external sensor to the robotic car
  2. The memory size is small, we can only implement few features in our firmware

  Improvements:

  Change the microcontroller to more advanced ones (i.e.. QUALCOMM 8xxx series)

EASY WAY

29

Flaws and Future Improvements

- Line tracing system
  1. The robotic can only follow the black line on the ground, the black line on the ground is not looking good to customers
  2. Only one robotic car can move on one lane

Improvements:

use special paint to draw the line (which is not visible to human eyes) and use special light sensor to track the light reflection.

Add more lines with different colors to support more than one robotic cars on one

EASY WAY

Flaws and Future Improvements

- Infrared communication
  1. All the robotic cars share the same infrared communication frequency
  2. If we have more than one robotic cars, they will receive the same information from surface tablet
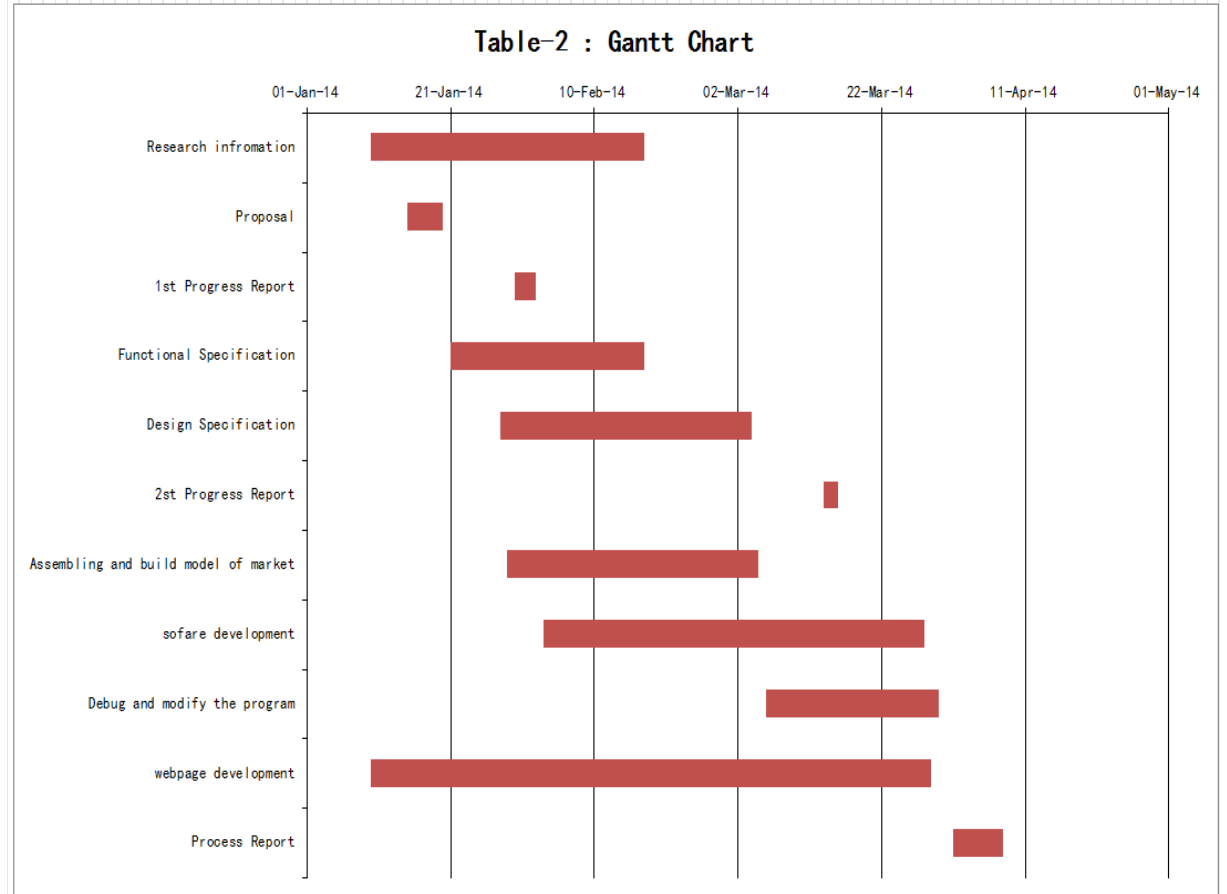
  Improvements:

  Use different frequency on infrared communication to eliminate the interference

EASY WAY

Scheduling

- On time at the beginning to Mid of Mar (search, S/W, soldering)
- Not on time from mid of Mar
- Reasons:
- Changed designed (main)
- UI
- Effects:
- Less time to test/ improve

Table-2 : Gantt Chart

EASY WAY

Finanical part

Equipment	Estimated Cost
Tweezers and Soldering Accessories	$40.00
USB IR Transceiver	$40.00
Parts and Components (such as wheels)	$80.00
ULT-Board	$40.00
Snake-Board	$90.00
Maker	$20.00
Hardboard	$25.00
Cable	$15.00
LCD Panel Board	$80.00
Motors	$50.00
Power Supply	$30.00
Total Cost	$510.00

Table-1: Original Tentative Budget

Equipment	Quantity	Cost
Robotic	2	$200
Motors	2	$50
USB IR Transceiver	1	$60
Barrier Sensor	1	$50
Power Supply	1	$30
Layout	1	$40

Table-2 Final Budget

Conclusion

1) Complex project that was done within four months

2) Deviations to our functional specification due to time and resource constraints

3) Still has flaws and requires a lot of future development

4) Mutual assistance and communication really helped

5) Primary function of the system is achieved

EASY WAY

Acknowledgement

- Professor Andrew Rawicz
- Professor Steve Whitmore
- Lukas—Karim Merhi
- Jamal Bahari
- Prerna Batta
- 440/305 TA's
- Frank Feng (SFU ENSC graduated, full—time employee at Teradici)

References

- WinAVR compiler:

http://www.webring.org/l/rd?ring=avr;id=59;url=http%3A%2F%2Fwinavr%2Esourceforge%2Enet%2F

- Assembly and Operation MANUAL:

http://www.arexx.com/downloads/asuro/asuro_manual_en.pdf

- ATmega8 Data Sheet

http://www.atmel.ca/Images/Atmel-2486-8-bit-AVR-microcontroller-ATmega8_L_datasheet.pdf

- SFH5110 Data Sheet

http://docs-europe.electrocomponents.com/webdocs/08b4/0900766b808b4438.pdf

Q&A

- *Thank you very much!*

EASY WAY