DETACHABLE
POTHOLE DETECTION AND WARNING SYSTEM

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Existing work

- Obstacle detection
  - Mechanical
  - Image processing
  - Mostly protruded obstacles

- Auntonomous avoidance

Current needs

- Pothole detection
  - for baby strollers, wheelchairs , grocery carts etc.

- Warning system only
  - not autonomous control
  - wheelchair users prefer manual control
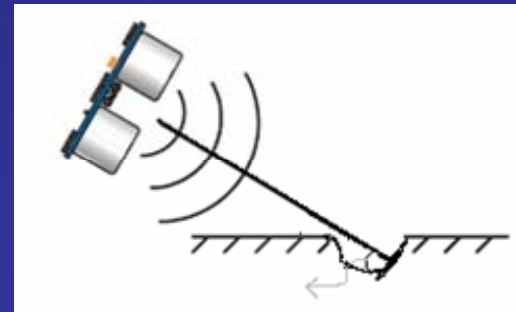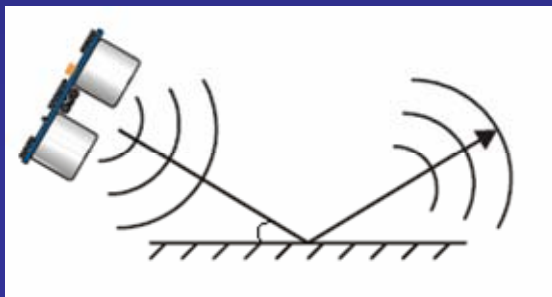 - too risky for baby strollers

Project Objective

- To build a handy, detachable, user-friendly device that can be mounted on a variety of human-maneuvered slow-speed vehicles.

Focus on : baby strollers
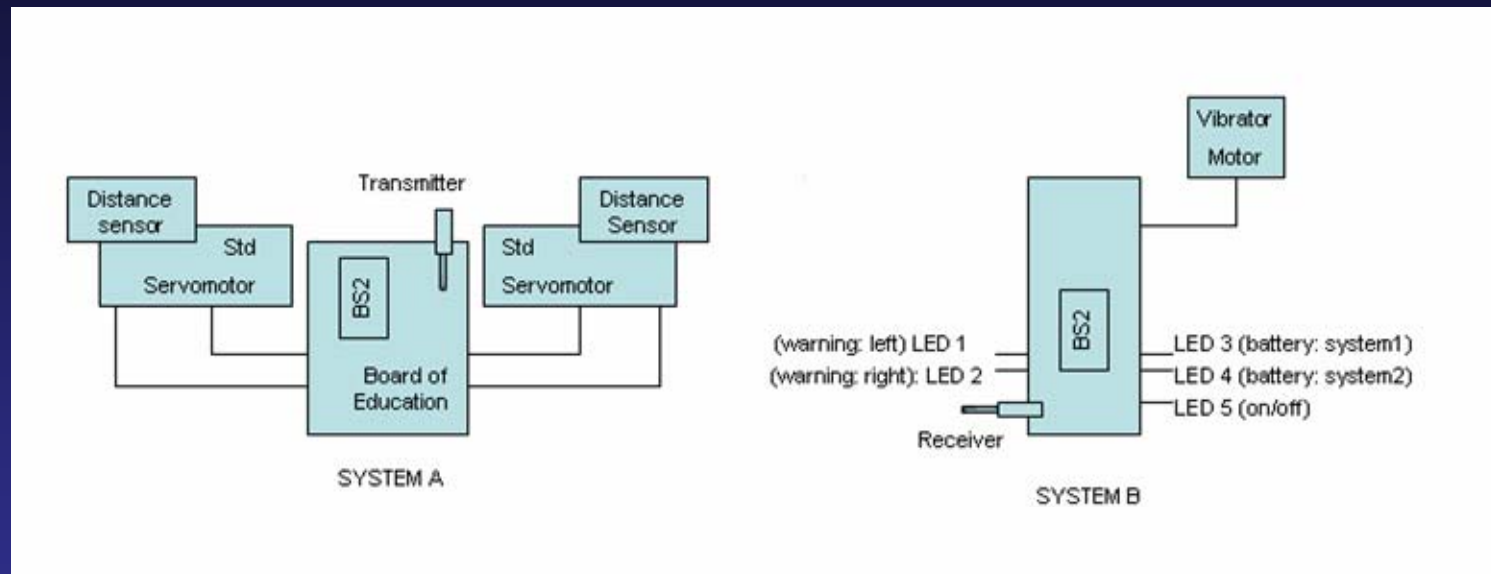
Detection method

- Attempt
  - Mechanical extension: bulky , already done
  - Laser sensors : too sensitive , costlier

- Chosen

  - PING)))™ Ultrasonic Distance Sensor (#28015)

Warning Method

- Vibration Motor
  - Can be turned off if desired
- LEDs
  - Two for obstacles
  - Two for battery levels
  - On/off
- Battery meter
  - Using voltage divider

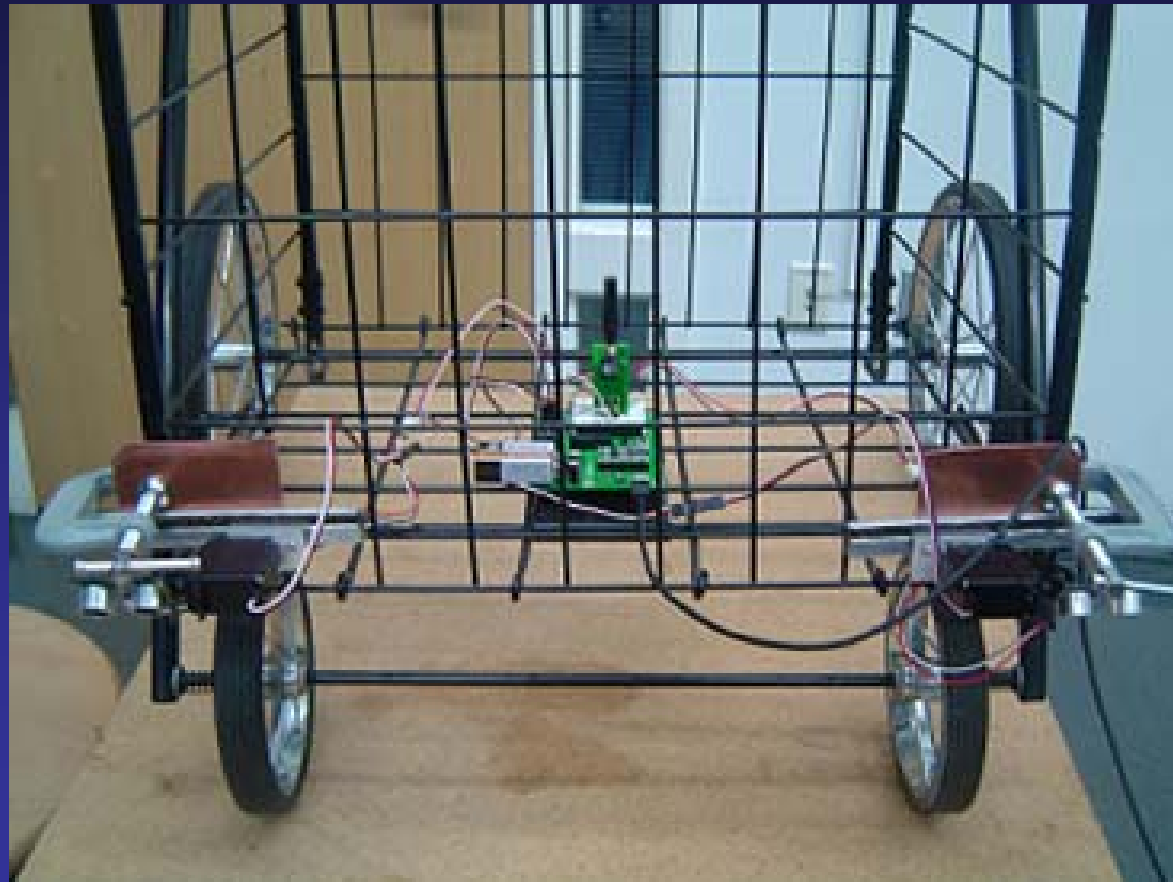# Overall structure

- System A attached to front of vehicle
- System B worn on wrist

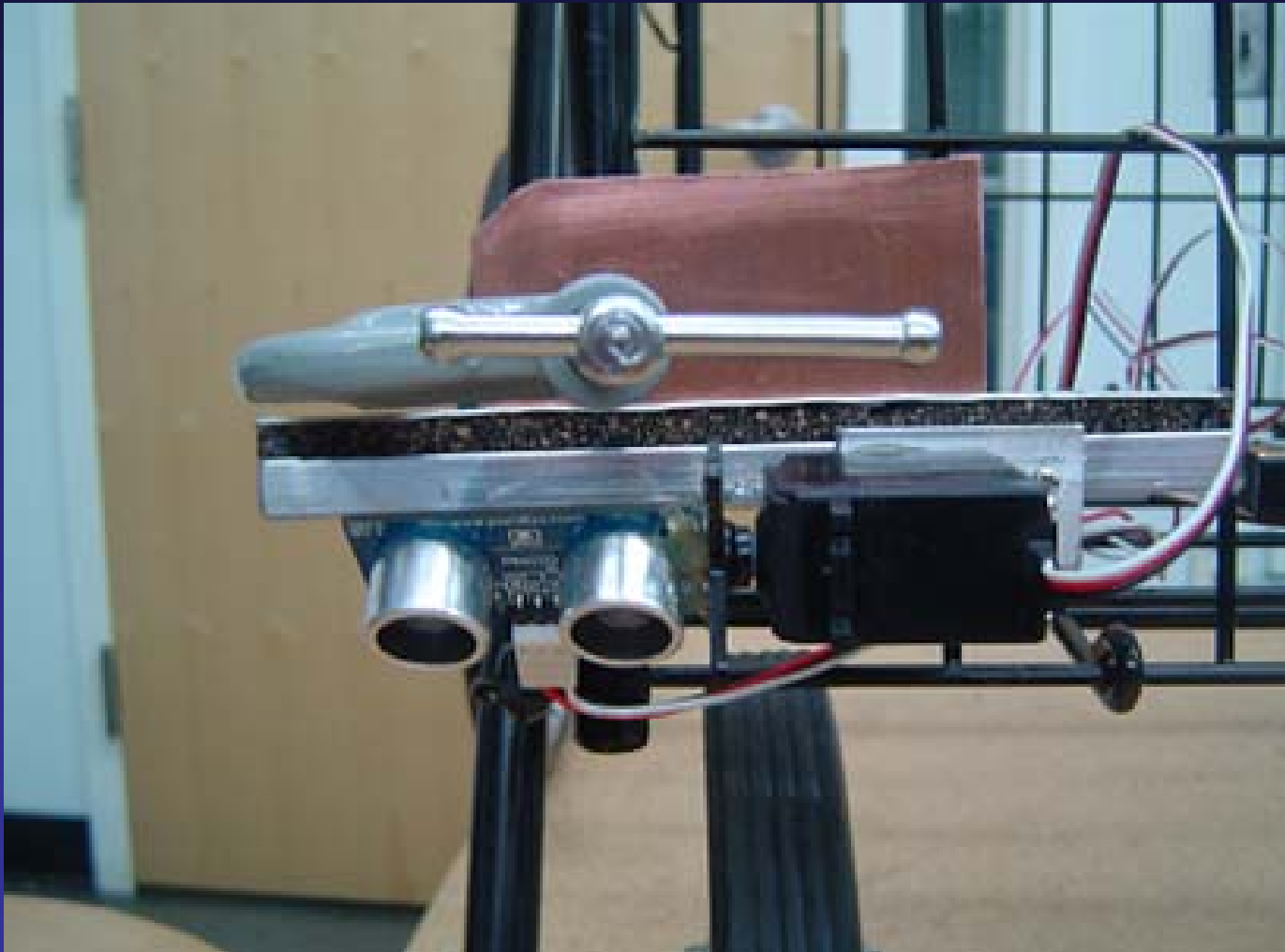# Mechanical Design
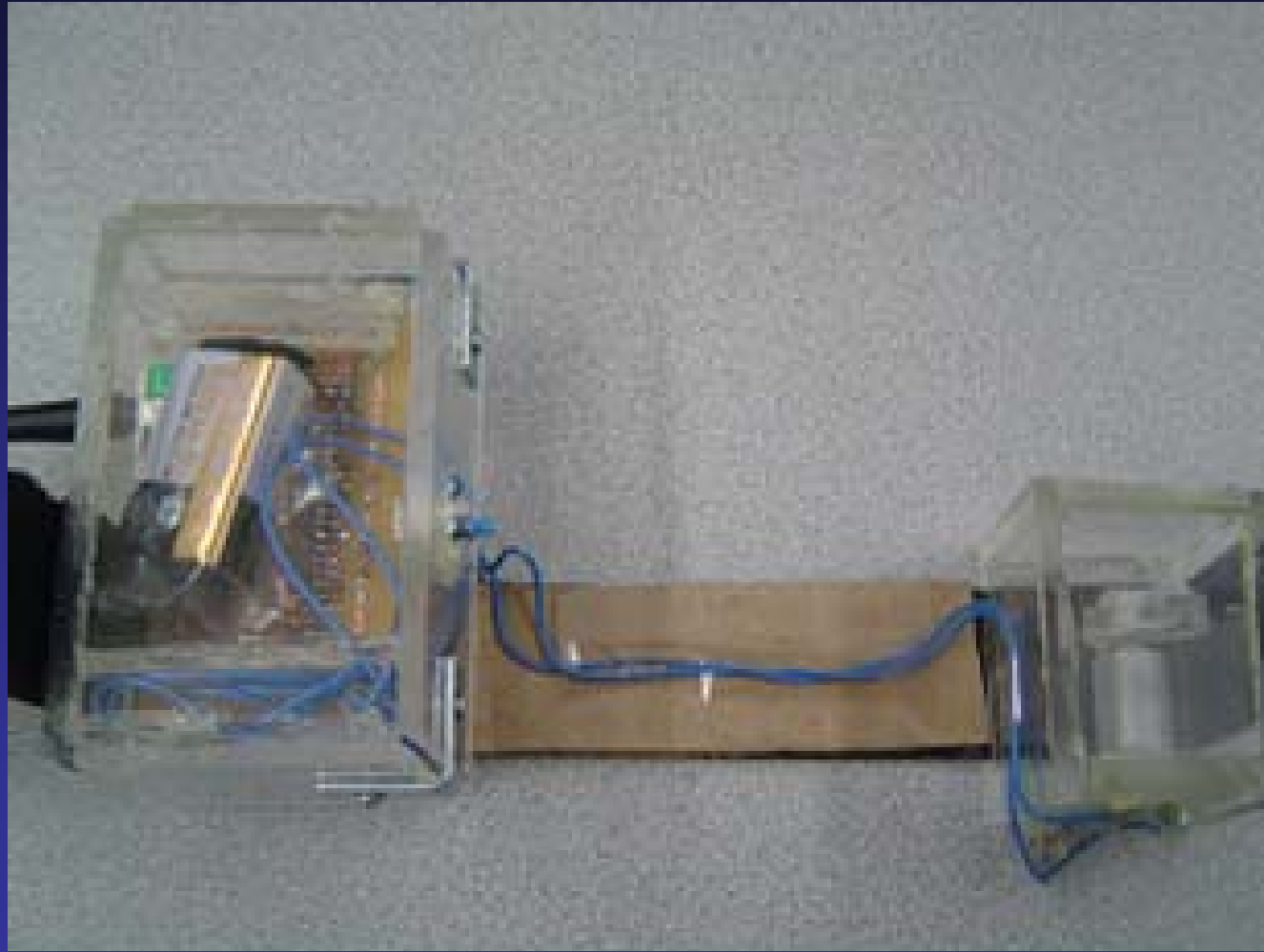## System A

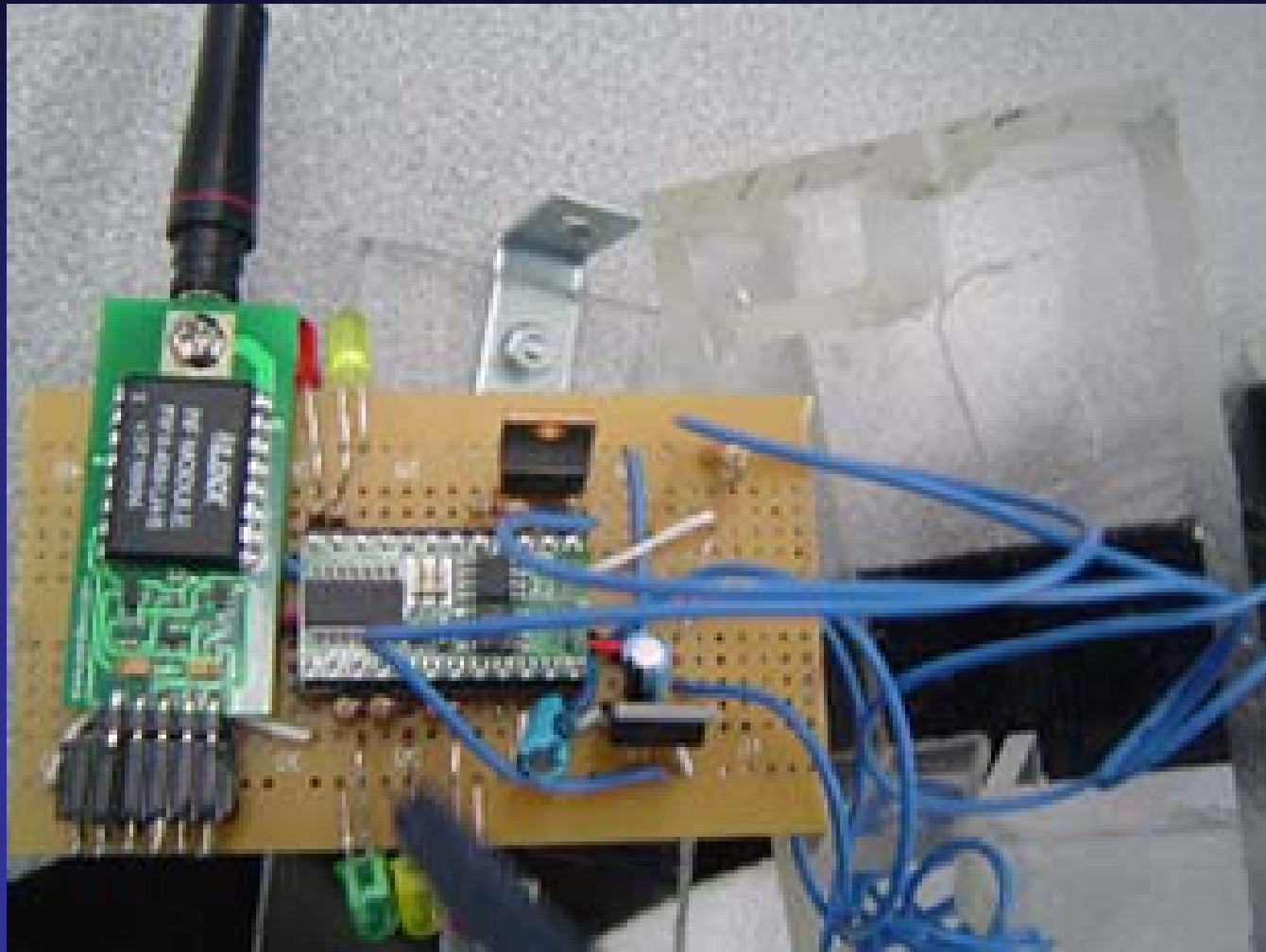# Mechanical Design
System A : close-up

Mechanical Design
System B

Mechanical Design
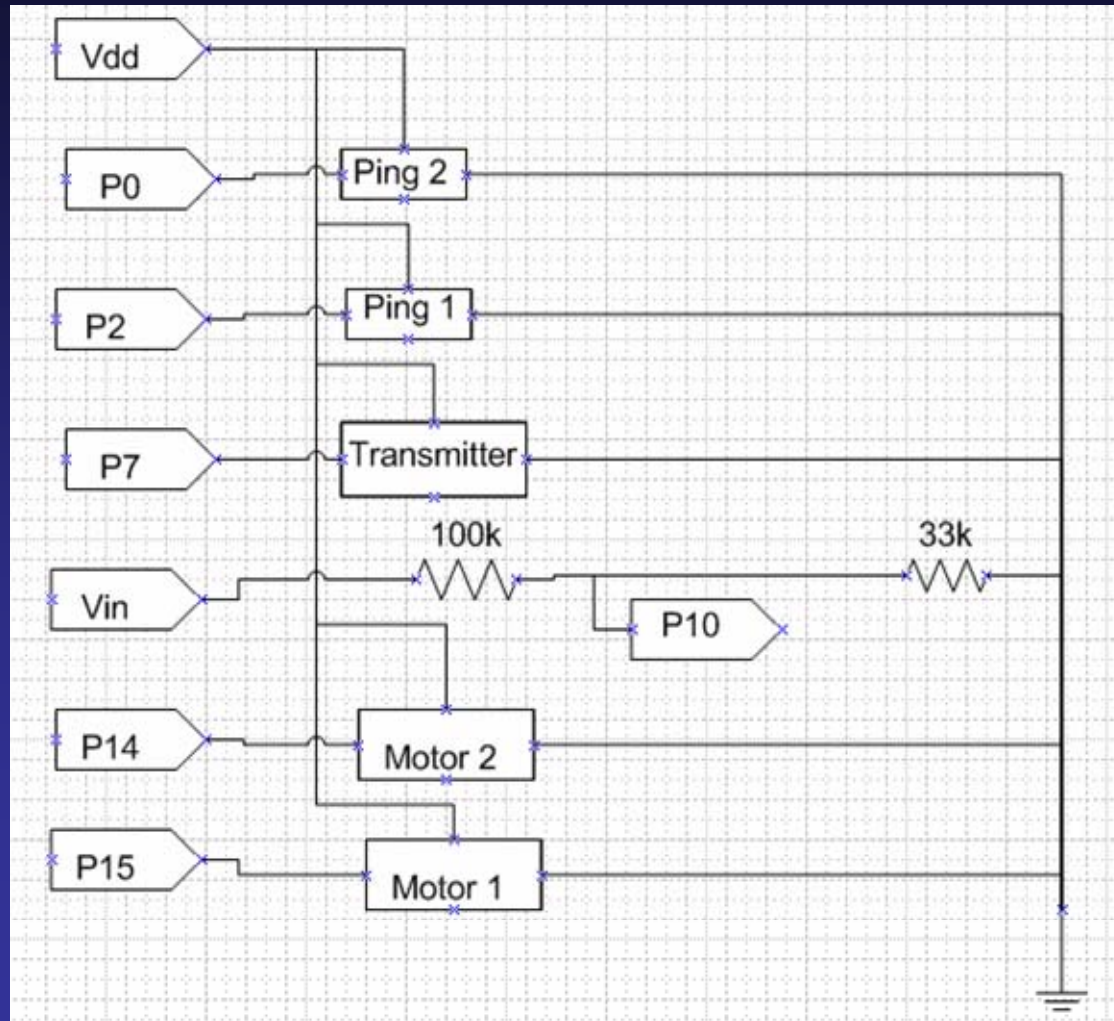## System B: Vibrator Motor close-up
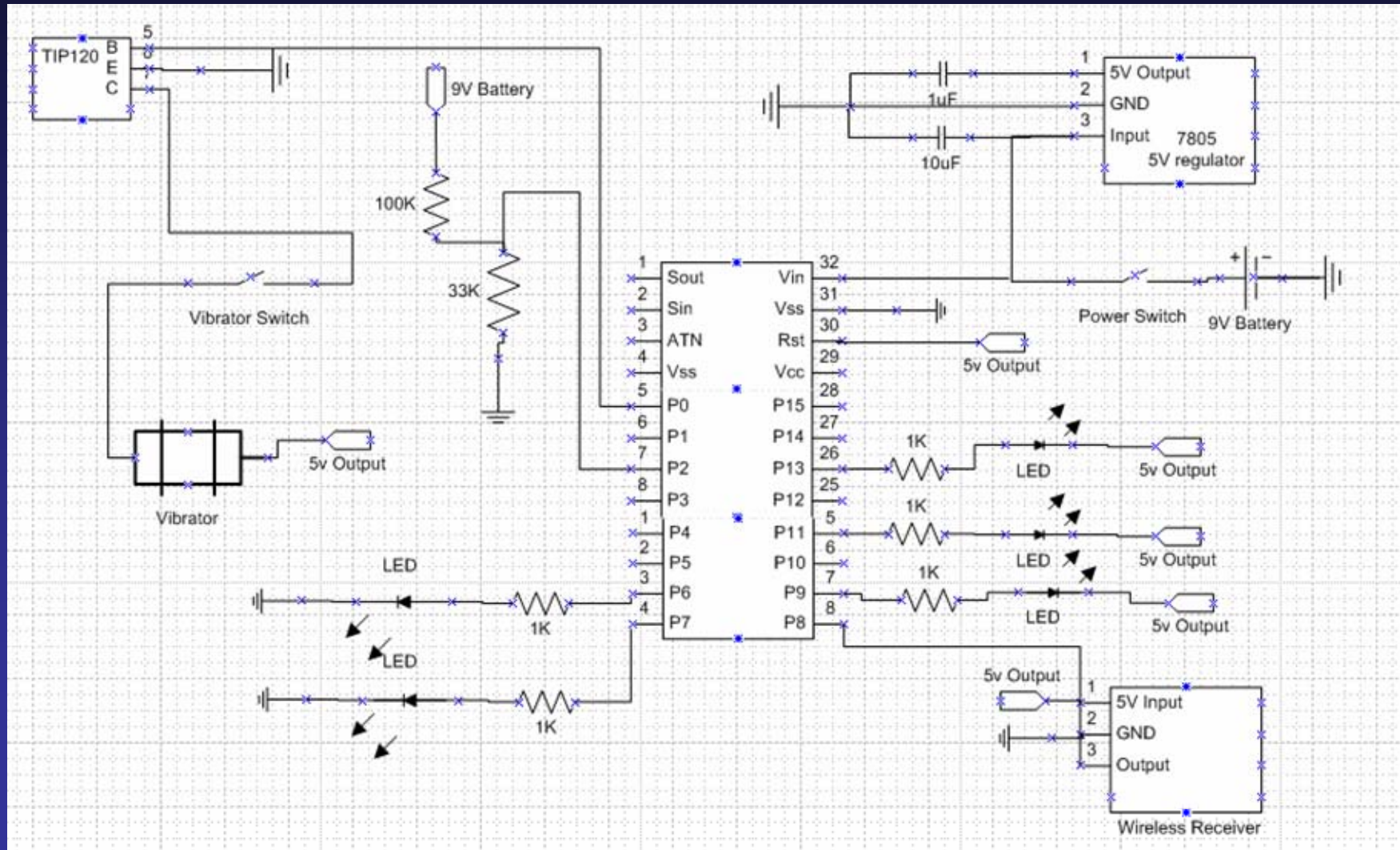
Circuit of System B

Circuit Diagram
System A

Circuit Diagram
System B

PBasic Code
System A

```
'name the variables
initialdistance1 VAR Word
initialdistance2 VAR Word
distance1 VAR Word
distance2 VAR Word
counter VAR Byte
motorAngle1 VAR Byte
motorAngle2 VAR Byte
warning VAR Byte

'assign the pins
ping1 PIN  2
ping2 PIN  0
motor1 PIN 15
motor2 PIN 14
battery PIN 10

'initialize parameters
motorAngle1 = 50
motorAngle2 = 100
DIR10 = 0

' Make the sensors face downwards
FOR counter = 1 TO 25
  PULSOUT motor1, motorAngle1*10
  PULSOUT motor2, motorAngle2*10
  PAUSE 20
NEXT
```

```
'---------Search for critical angle ------

getCriticalAngle:

GOSUB getDistance

IF 2260**distance1 < 300 THEN
  motorAngle1 = motorAngle1 + 1
    FOR counter = 1 TO 10
      PULSOUT motor1, motorAngle1*10
      PAUSE 20
    NEXT
  GOTO getCriticalAngle
ELSEIF  2260**distance2 < 300 THEN
 motorAngle2 = motorAngle2 - 1
    FOR counter = 1 TO 10
      PULSOUT motor2, motorAngle2*10
      PAUSE 20
    NEXT
  GOTO getCriticalAngle
ELSE
  motorAngle1 = motorAngle1 - 1
  motorAngle2 = motorAngle2 + 1
    FOR counter = 1 TO 10
      PULSOUT motor1, motorAngle1*10
      PULSOUT motor2, motorAngle2*10
      PAUSE 20
    NEXT
  GOSUB getDistance
  initialdistance1 = 2260**distance1
  initialdistance2 = 2260**distance2
  motorAngle1 = motorAngle1 + 1
  motorAngle2 = motorAngle2 - 1
    FOR counter = 1 TO 10
      PULSOUT motor1, motorAngle1*10
      PULSOUT motor2, motorAngle2*10
      PAUSE 20
    NEXT
  GOTO detectPothole
ENDIF
```

PBasic Code
System A

```
'---------- Detect Pothole----------------------'
detectPothole:

DO

  GOSUB getDistance

    IF 2260**distance1 > (initialdistance1 + 5) AND 2260**distance1 < 100 THEN    'right
      warning = 2
    ENDIF

    IF 2260**distance2 > (initialdistance2 + 5) AND 2260**distance2 < 100 THEN    'left
      warning = 4 + warning
    ENDIF

    IF battery = 0 THEN
      warning = 1 + warning
    ENDIF

  PULSOUT 7, 1200
  SEROUT 7, 16468, [ "!", warning]
  PAUSE 10
  warning = 0

LOOP

END
```

```
'---------- Get Distance --------------------'

getDistance:

PULSOUT ping1,5
PULSIN  ping1,1, distance1
PULSOUT ping2,5
PULSIN  ping2,1, distance2

DEBUG CLS, DEC5 2260**distance1, "        ", DEC motorAngle1*10, "        ", DEC initialdistance1
DEBUG CR, DEC5 2260**distance2, "        ", DEC motorAngle2*10  , "        ", DEC initialdistance2
DEBUG CR, DEC battery
PAUSE 100
RETURN
```

PBasic Code
System B

```
' pin 7 left
' pin 6 right
' pin 8 reciver
' pin 9 ON/OFF
' pin 11 hand held battery
' pin 13 cart battery
' pin 2 battery meter
' pin 0 motor contorl


control VAR Byte
'control
'LSB down TO msn
'0  cart battery active high
'1  right
'2  left



DIR9 = 1
DIR2 = 0
DIR13 = 1
DIR6  = 1
DIR7  = 1
DIR0 = 1
```

```
LOW 9   'power
HIGH 13

DO

OUT11 = IN2 ' handheld battery

SERIN 8, 16468, [WAIT("!"), control]

IF control < 7 THEN

OUT13  = ~control.BIT0
OUT6   =  control.BIT1
OUT7   = control.BIT2

    IF control >= 2 THEN
        OUT0 = 1
        PAUSE 500
        OUT0 = 0
    ENDIF

ENDIF

LOOP
```

Prototype Cost

Serial No.	Item Name	Quantity	Price per item ($)	Total cost ($)
1	BASIC Stamp 2 Module	2	49	98
2	BS2 Board of Education	1	69.95	69.95
3	PING))) Ultrasonic Distance Sensor	2	29.95	59.9
4	Standard Servo (#900-00005)	2	12.95	25.9
5	DC Vibration Motor	1	2	2
6	Parallax 433.92 MHz RF Transmitter (#27980)	1	39.95	39.95
7	Parallax 433.92 MHz RF Receiver (#27981)	1	39.95	39.95
8	Velcro	1	4	4
9	C-Clamp	2	4	8
10	Connection cables/wires	2	3	6
11	Plexiglas	1	5	5
12	NPN BJT TIP120	1	0.40	.40
13	7805 Voltage Regulator	1	1	1
	GRAND TOTAL			360.55

Mass Production Cost Estimate

Serial No.	Item Name	Quantity	Price per item ($)	Total cost ($)
1	PIC micro controller	2	2.50	3
2	Custom Ultrasonic Distance Sensor w/ Circuitry	2	7	14
3	Standard Servo (#900-00005)	2	5	10
4	DC Vibration Motor	1	2	2
5	Custom RF Transmitter	1	5	5
6	Custom RF Receiver	1	5	5
7	Velcro	1	0.20	0.20
8	C-Clamp	2	1	2
9	Switches	2	0.10	0.10
10	Plastic Cover	1	1	1
11	NPN BJT TIP120	1	0.05	.05
12	7805 Voltage Regulator	1	.05	0.05
	GRAND TOTAL			40.40

CONCLUSION

- Prototype was successful
- Possible improvements
  - Smaller wrist part
  - Earlier detection of potholes.