SabZ Inc.

Unipark-1000

An Easy to Install Vehicle Parking Sensor

KENNY LAM – CEO

EDMOND MO – CFO

WILL ZHANG – COO

HAMIDREZA HAGHSHENAS – CTO

Outline

- Introduction
  - Team, Mission, Target Customer, Features
- Project Management
  - Schedule, Budget, Group Dynamics
- Design
- Implementation and Testing
- Individual Involvement
- Demo section
- Questions

Introduction

Team Members

- Kenny Lam – CEO
- Edmond Mo – CFO
- Hamidreza Haghshenas – CTO
- Will Zhang – COO

Mission Statement

To mitigate the hassles of vehicle parking by providing drivers with easy access to advanced parking assistance technology.

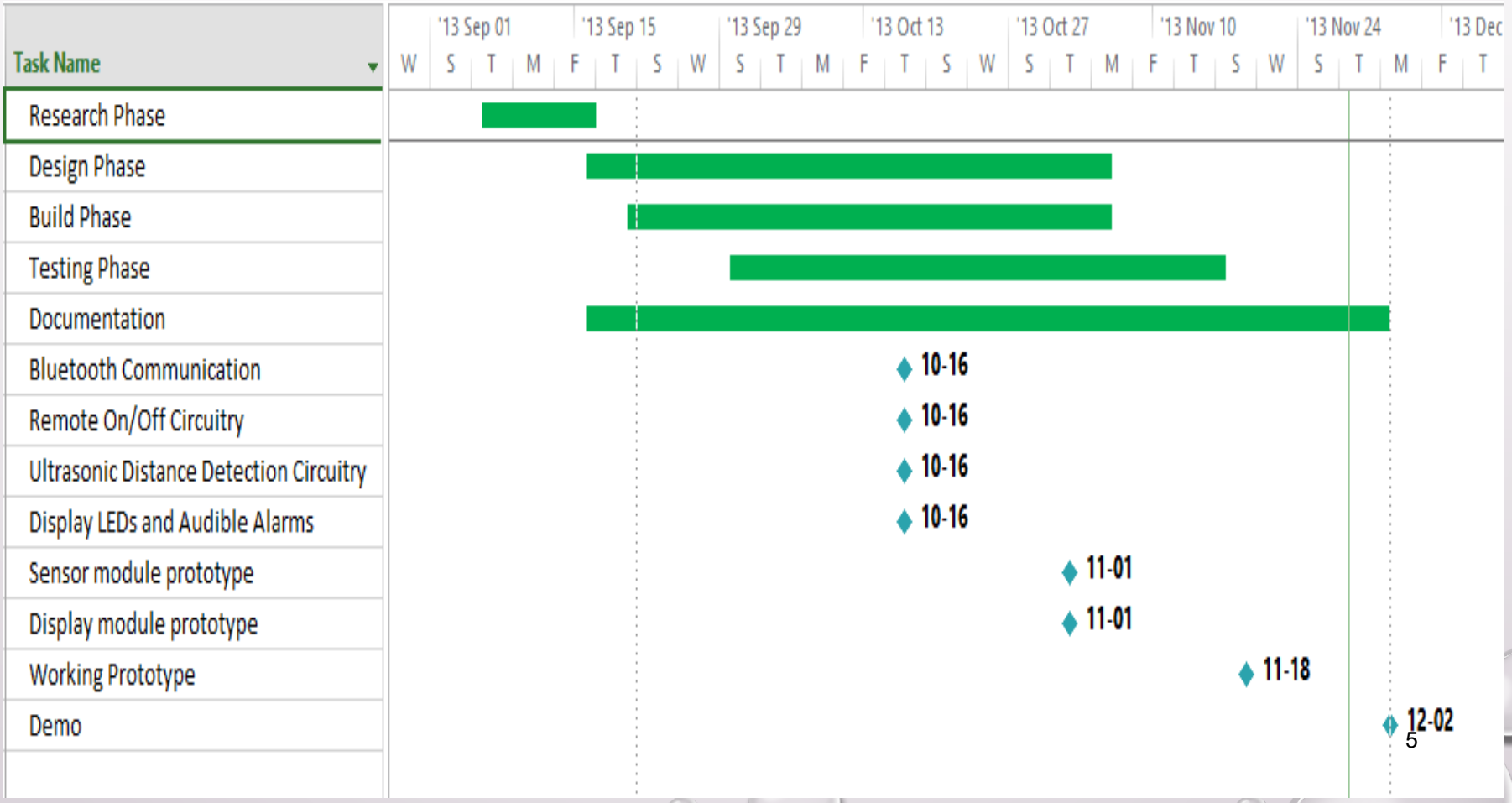
TARGET MARKET/CUSTOMER

- NON SKILLED INDIVIDUAL SHOULD BE ABLE TO INSTALL THIS PRODUCT WITH ONLY ONE SCREW DRIVER IN LESS THAN 15 MINUTES.
- COMMERCIAL TRUCKS WILL BE AVOIDING LONG WIRINGS.
- CANNOT AFFORD EXPENSIVE PARKING SENSORS

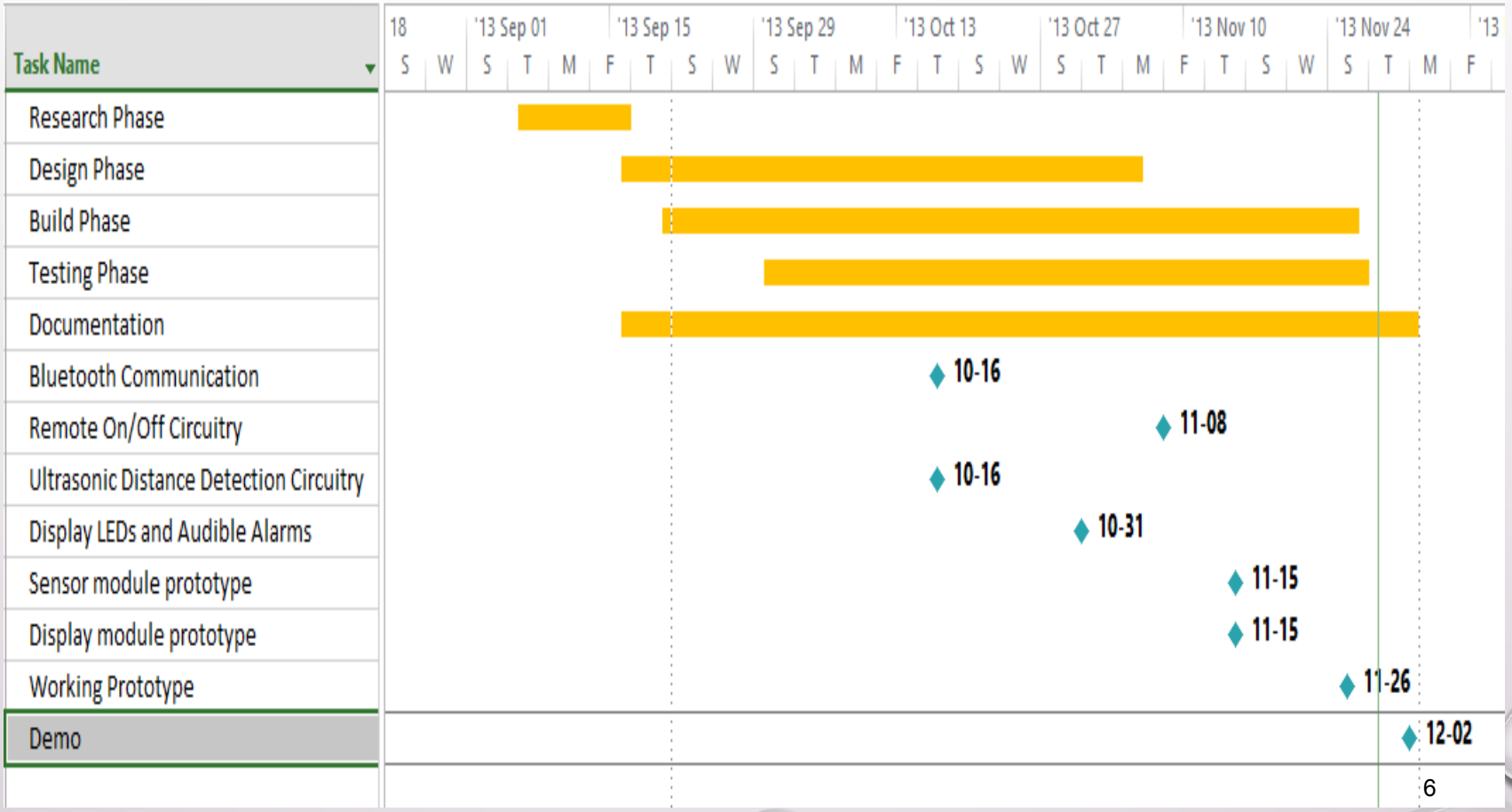
ADVANTAGE/NEEDS

- NO DAMAGE OR ANY DRILLING NEEDED TO INSTALL THE DEVICE.
- AVOID ANY WIRINGS
- WILL MAKE THE PARKING EASIER FOR SOME PEOPLE
- CHEAPER

Project Management: The Schedule



Project Management: The Schedule



PROJECT MANAGEMENT: THE BUDGET

Budget summary throughout the project:

- Funding from ESSS		+$500.00
- Total spending on R&D effort	-$777.65	
- Budget exceed by		+$277.65

For more detail about the spending, please refer to the expense report.

Project Management: Group Dynamics

- Group meeting every week
- Separate tasks
- Work together to solve problem
- Team writing (google doc)
- Communication through emails, phone call and Canvas
- Encourage each other
- Team Planning
- Embracing Diversity

System design: Functionality

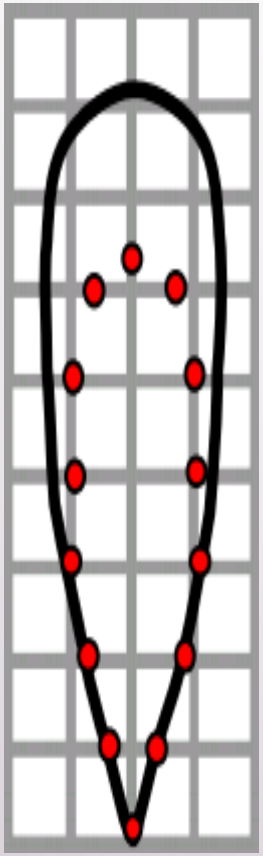
- System consists of 2 sensor modules and 1 display module
- Communicates distance data wirelessly
- Refreshes data 3 to 4 times per second
- Remotely powers sensor modules on
- Ultrasonic distance detection

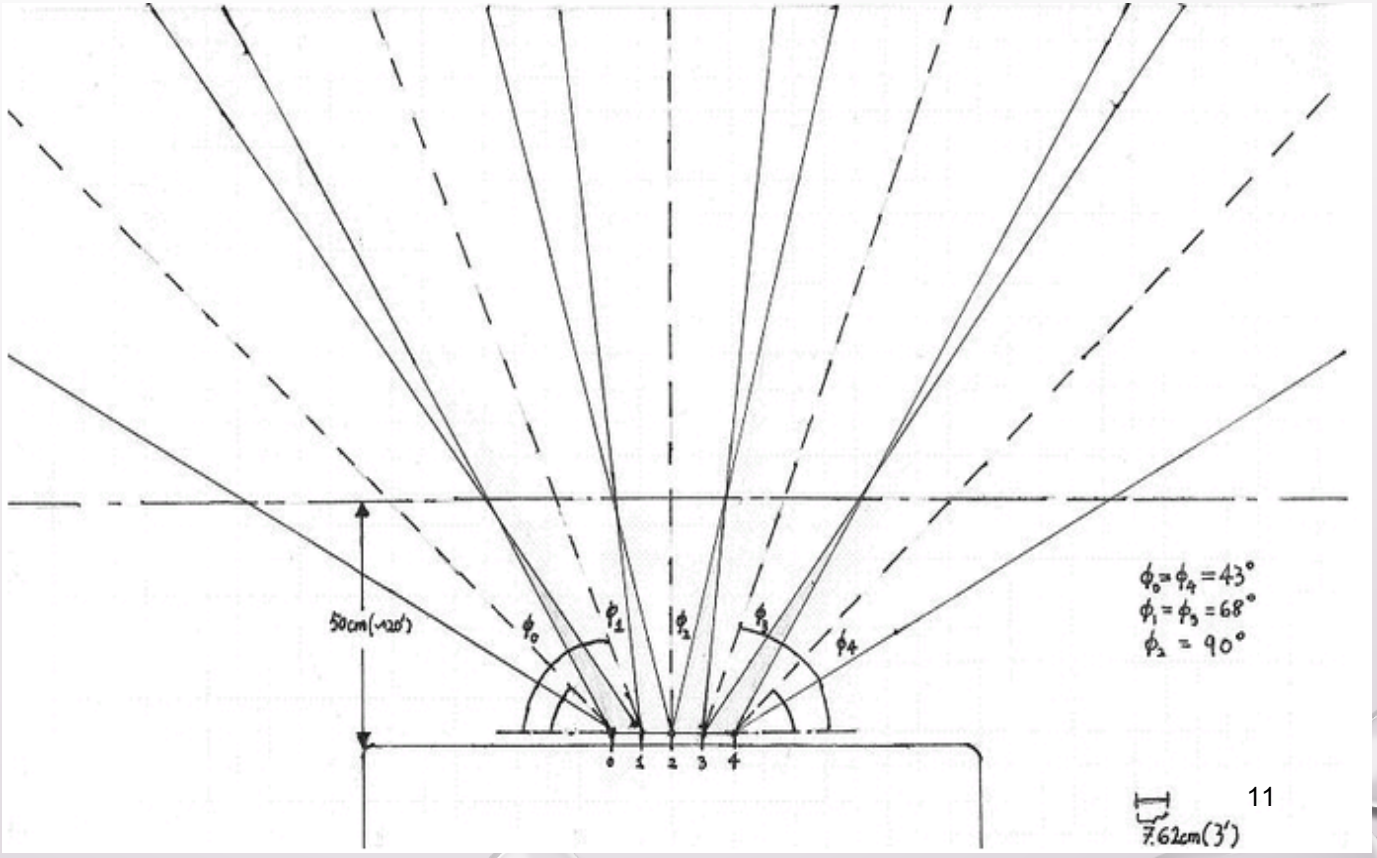
System Design: Parking Sensor technology-1

- Ultrasound versus MagnetoresistiveDecided to choose ultrasound technology over Magnetoresistive due to the form factor of the sensors

  Using ultrasonic sensor allow a more compact design

System Design: Parking Sensor technology-2





System Design: Installation process

-> Installation video

System Design: Remote circuit

- Why remote circuit?
- Using 433mhz radio frequency transmitter and receiver
- Why rf ?

  - Good Range

  - Simplicity

  - Loss change of interference problems

Pair transmitter and receiver with encoder and decoder to build a simple RF communication

- Transmitting circuit - Display module
- Receiving circuit - Sensor module

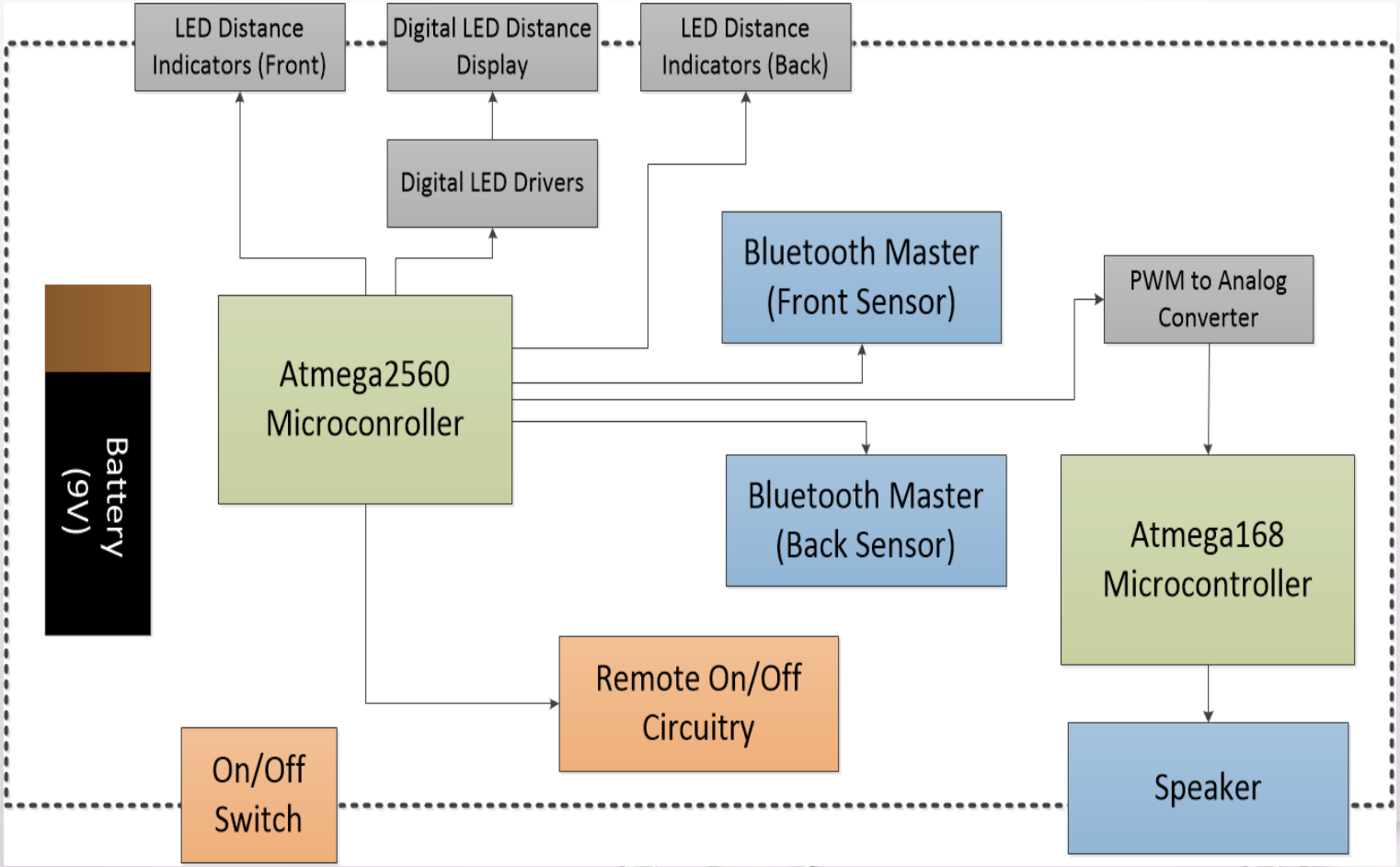
System Design: Bluetooth Communication

Why bluetooth communication?

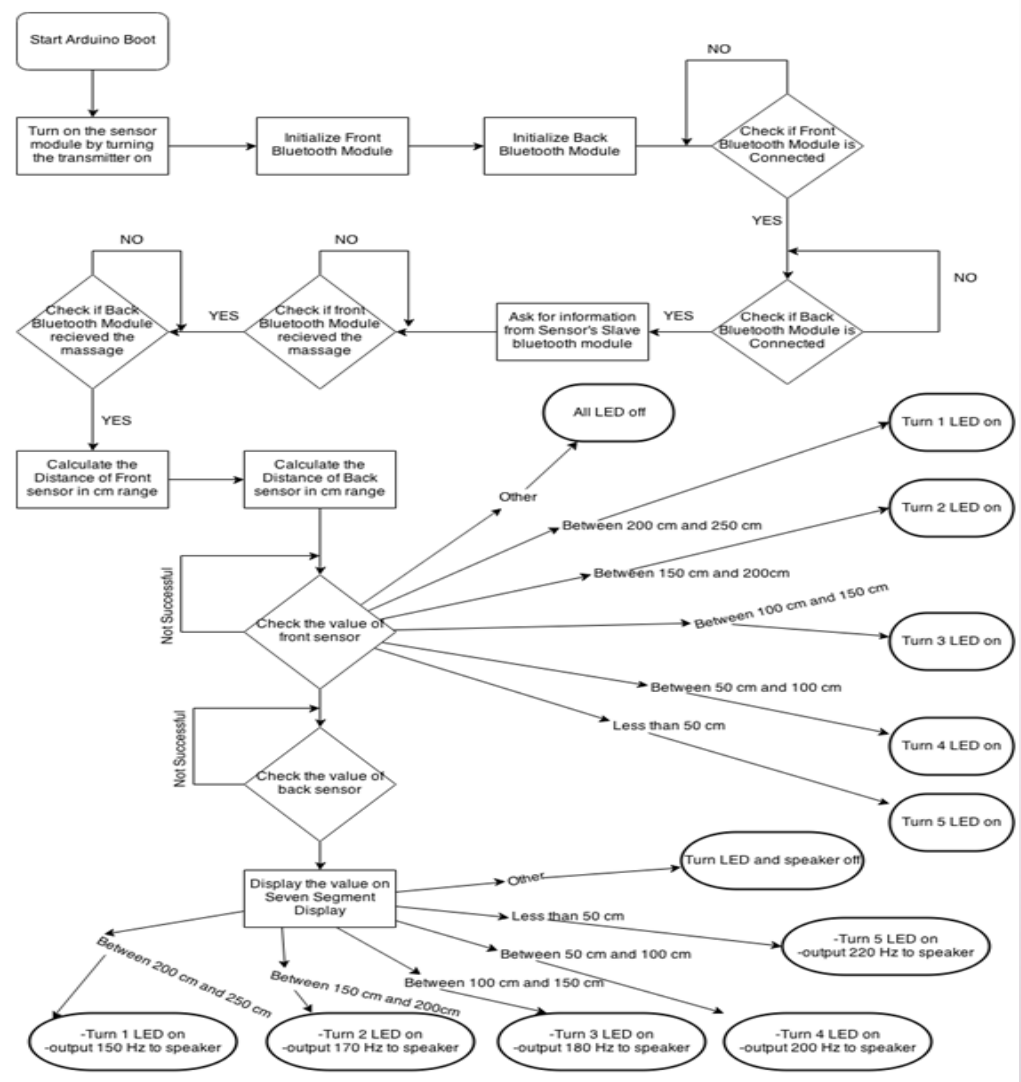
- low power
- well documented
- easy to use
- other options (wifi, RF)

TECHNICAL INFORMATION

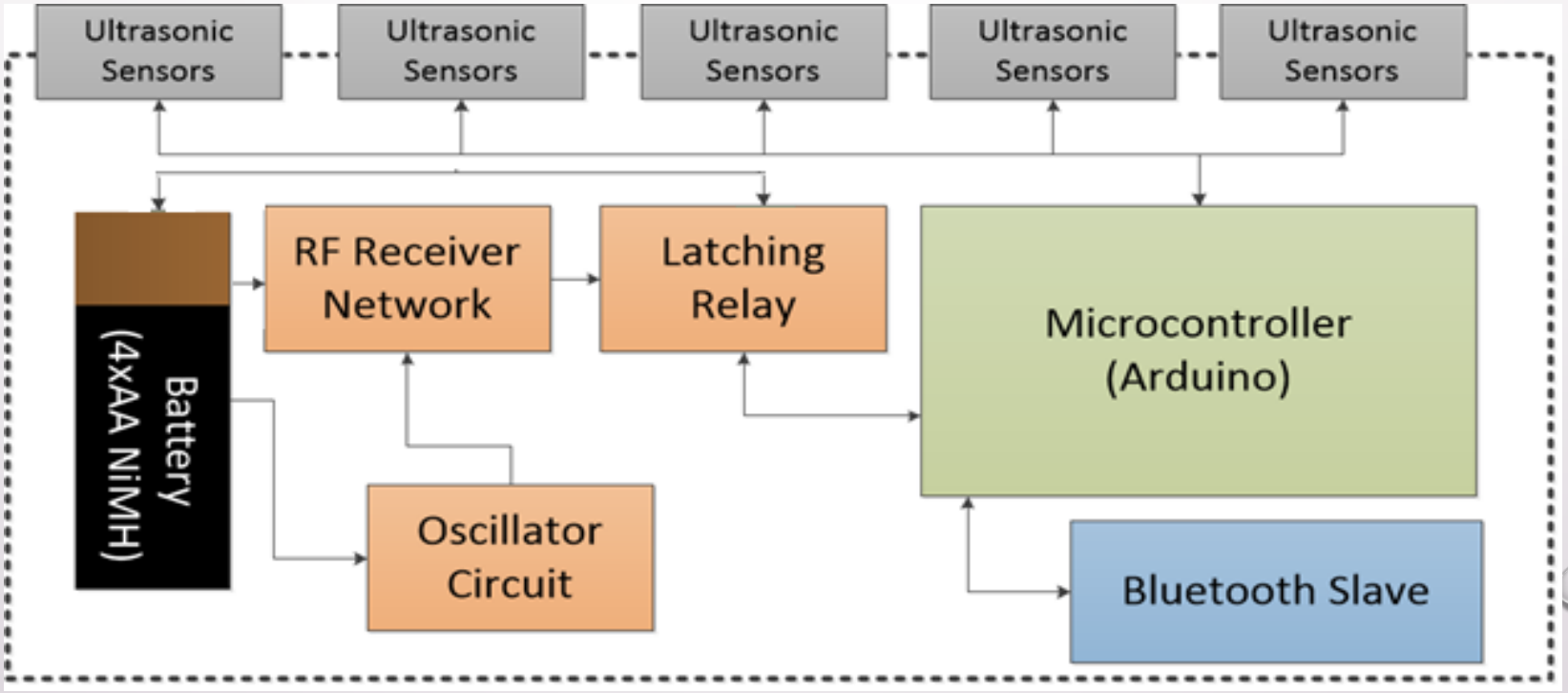
DISPLAY MODULE HARDWARE



SOFTWARE-DISPLAY MODULE



SENSOR MODULE HARDWARE



SENSOR MODULE SOFTWARE - 1

Pseudocode of application code on uController

```
void main() {
        uint32 sensor_array[5];
        float shortest_d;

    while ( ;; ) {
            sensor_array = read_range();
            shortest_d = calculate_shortest_distance( sensor_array );
            if ( bt_request_from_display_module() ) {
                bt_send_data( shortest_d );
        }  else {
            if ( no_bt_request_for_longer_than_60s() ) {
                power_off();
            }
        }
    }
}
```

SENSOR MODULE SOFTWARE - 2

PSEUDOCODE CONTINUE

```
float calculate_shortest_distance(uint32 *sensors_array) {

        float shortest_distance, temp_f;

        shortest_distance = (float)*(sensors_array)*0.6820;
        for ( int i=0, i<5; i++) {
                if (i==1 || i==3) {
                        temp_f = (float)*(sensors_array+i)*0.9272;
                        if (temp_f < shortest_distance) { shortest_distance = temp_f;}
                }
                else if ( i==2 ) {
                        temp_f = (float)*(sensors_array+i);
                        if (temp_f < shortest_distance) { shortest_distance = temp_f;}
                 }
                else if ( i==5 ) {
                        temp_f = (float)*(sensors_array+i)*0.6820;
                        if (temp_f < shortest_distance) {  shortest_distance = temp_f;}
                 }
    }


        return shortest_distance;
}
```

Implementation

- Design and Testing of Components
- Integration of Components onto Breadboard
- Construction of Proof-of-concept Prototype
- Installation of the Prototype onto a car

Testing

- Tested different scenarios (front in, back into the parking spot and parallel parking, pedestrian walking around the car, suddenly jumping into the sensor range, within a distance of 15m, the display module can still turn on the sensor module)
- Easy to install feature worked great
- Accurate measurements
- Stability

DESIGN ISSUES

- Audio Alarm beeps only for back sensor
- Location of the Sensors need to be changed for the purpose of making the device compatible on variety of cars
- Reduce the System start up time of Bluetooth communication
- Use Color LED for different distances
- Dead spots
- Spiking
- No Power button
- 9V battery

DESIGN ISSUES

- Display module should display 50cm when object comes closer than 50cm and there should be constant beep

- Antenna for transmitter and receiver circuit

- Sensor module should not display anything for distances greater than 200 cm.

FUTURE WORK

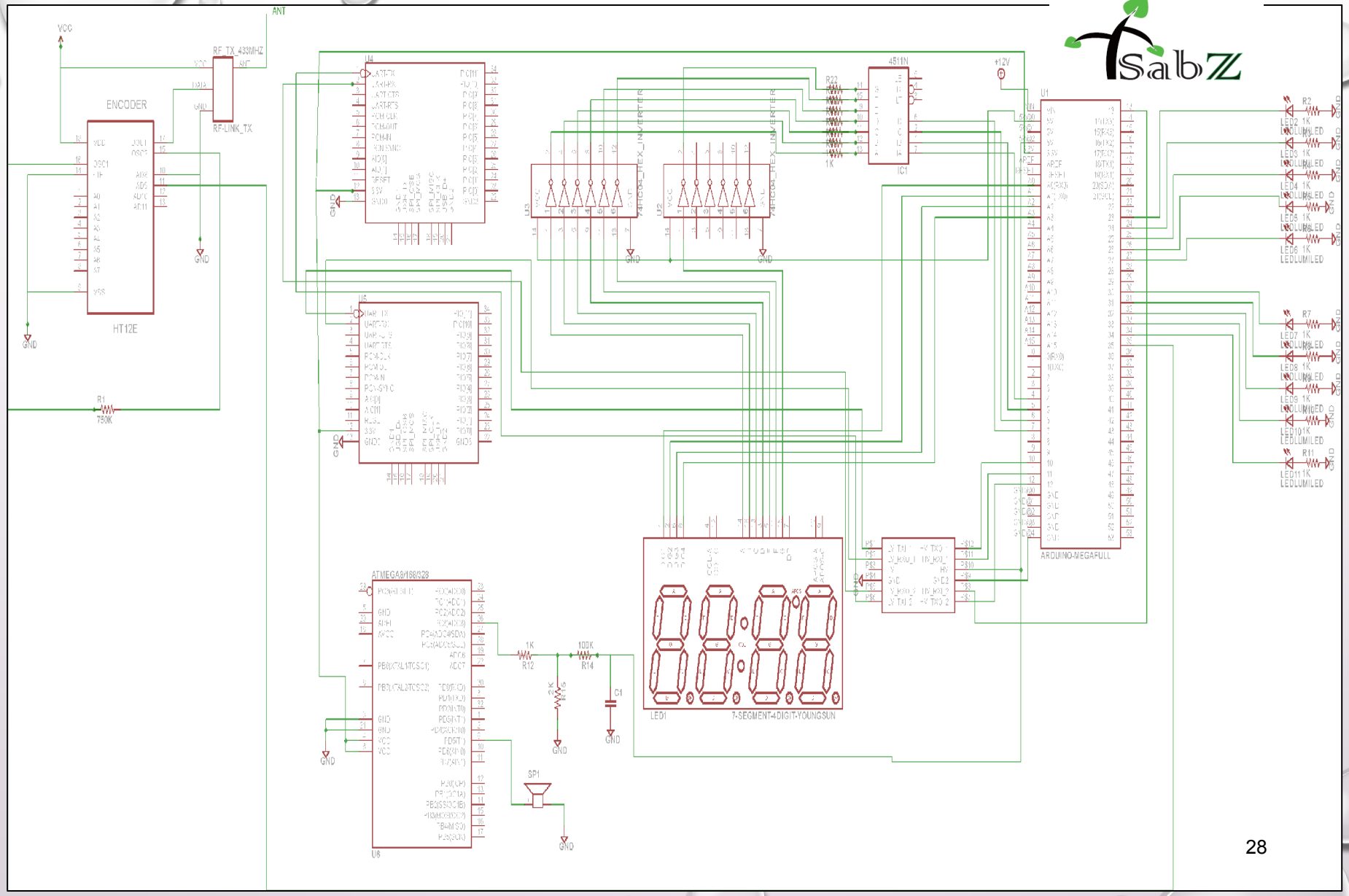
- **Bluetooth Communication**
- **Range Detection**
- **Range display Unit**
- **Remote on/off switching Unit**
- **Module Casing**
- **Sensor Module Battery Life**
- **PCB design for Display module**
- **PCB design for Sensor**
- **Complete test plan for prototype and final product**
- **Better test method for object detection**
- **Patenting Sensor/Display Module Design**
- **Planning For Mass Production**
- **Cost Analysis of Prototype**
- **Market Research**
- **Sustainability Consideration**

SUB-DIVISIONS

- DIVIDED INTO 4 PARTS AND EACH MEMBER IS RESPONSIBLE FOR THEIR PART
- KENNY – BLUETOOTH COMMUNICATION PROTOCAL
- EDMOND – ULTRASONIC DISTANCE DETECTION CIRCUITRY
- HAMID – DISPLAY AND AUDIBLE ALARM
- WILL – REMOTE ON/OFF CIRCUITRY

Hamid

- Documentation
- Responsible for design and integration of all components in Display module


ANT
VCC
RF_TX_433MHZ
ENCODER
RF-LINK_TX
HT12E
GND
R1
750K
U4
U5
U6
U2
U3
74HC04_HEX_INVERTER
4511N
IC1
+12V
U1
ARDUINO-MEGAFULL
R22
1K
R2
R7
R11
LED1 1K
LEDLUMILED
ATMEGA8/168/328
1K
R12
100K
R14
C1
SP1
LED1
7-SEGMENT-4DIGIT-YOUNGSUN

HAMID

- IMPLEMENT THE DESIGN INTO SOLDERABLE BREAD BOARD AFTER ALL THE TESTING WERE DONE ON BREAD BOARD.
- GROUP MEETINGS 3 TIMES A WEEK FOR 2 HOURS EACH(PROJECT WORKLOAD).
- 10 HOURS A WEEK FIRST 2 MONTHS
- 24 HOURS A WEEK LAST 1 MONTHS
- TWO OTHER COURSES
- READING THE MANUALS(IMPROVE PRODUCTIVITY)
- TIME MANAGEMENT
- ARDUINO WEBSITE
- ENSC 225,325,351,427,CMPT128

KENNY

RESPONSIBILITIES AND DUTIES

- DOCUMENTATION
- BLUETOOTH COMMUNICATION
- DISPLAY AND SENSOR MODULE CASING
- PROJECT MANAGEMENT
- DESIGN CONSULTATION AND TROUBLESHOOTING

KENNY

PROJECT WORKLOAD

- AVERAGE 10 HOURS PER WEEK FOR THE FIRST TWO MONTHS
- AVERAGE 25 HOURS PER WEEK IN THE LAST MONTH

FACTORS THAT INFLUENCED THE WORK LOAD

WAYS TO IMPROVE MY PRODUCTIVITY

USEFUL COURSES:

CMPT 128 + 225, ENSC 325, ENSC 489

COMMUNICATION AND WRITING COURSES

EDMOND - 1

RESPONSIBILITIES AND DUTIES

-DOCUMENTATION

-HARDWARE&SOFTWARE INTERFACE OF ULTRASOUND SENSOR

-PCB FOR SENSOR MODULE

-OSCILLATOR CIRCUITRY IN SENSOR MODULE

EDMOND - 2

PROJECT WORKLOAD

- AVERAGE ~15 HOURS/WEEK

FACTOR INFLUENCE WORKLOAD

- MAJORITY TIME SPENT IN RESEARCHING ON TOPIC

WAYS TO IMPROVE MY PRODUCTIVITY

- TAKE A BREAK ONCE IN AWHILE TO REVITALIZE

USEFUL COURSES

- CMPT128, ENSC452, ENSC350, ENSC450

Will

Responsibilities and duties

- documentation, meeting minutes
- Remote on/off circuitry

How to improve your productivity

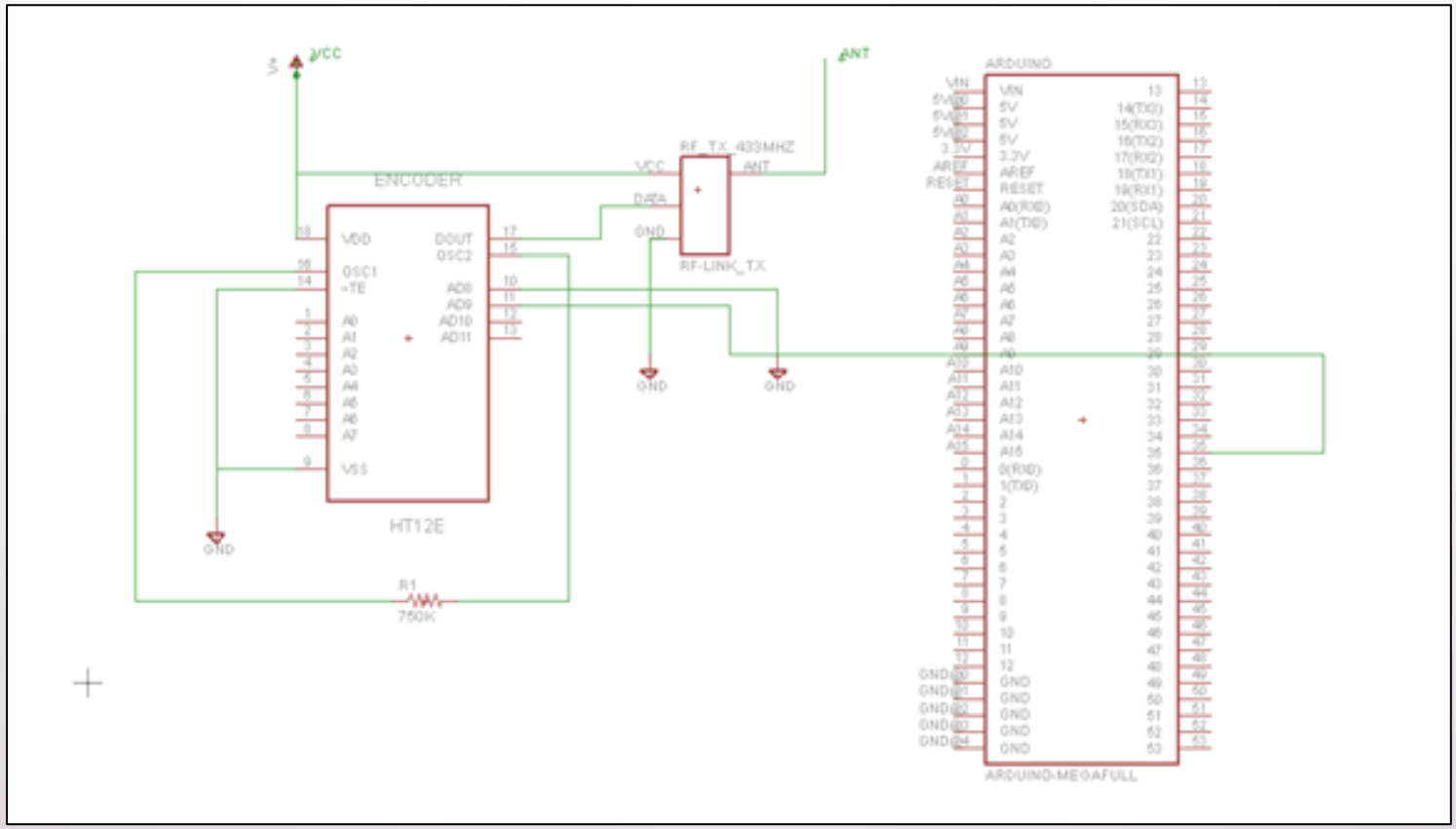
- Schedule ahead
- do more research
- test more

RESPONSIBILITIES

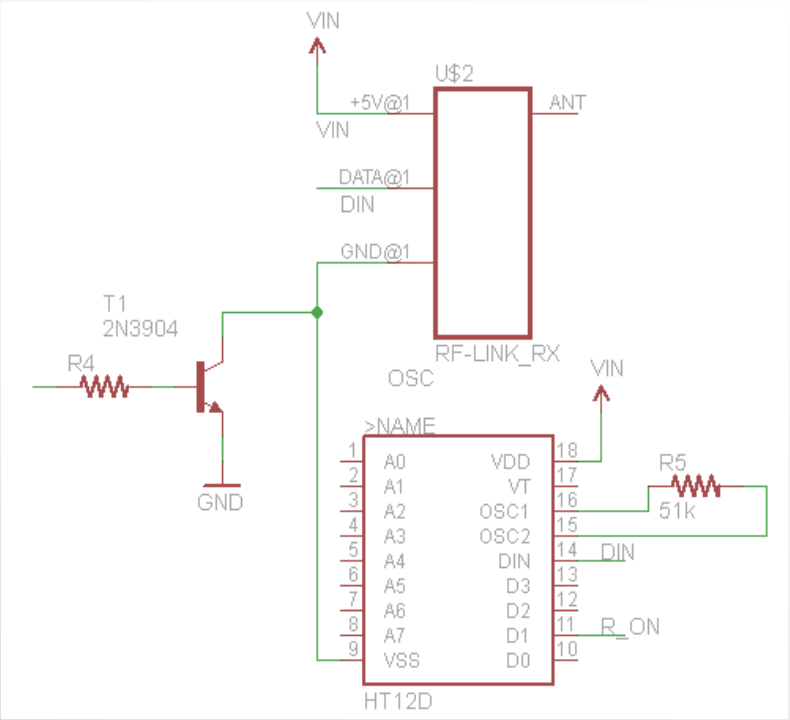
WORK LOAD

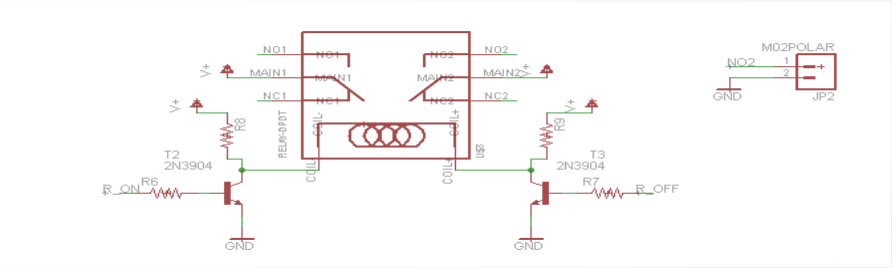
- 8-10 HOURS PER WEEK IN FIRST TWO MONTHS
- 20-30 HOURS PER WEEK IN LAST MONTH
- LAST TERM
- ENSC 220, 225,325

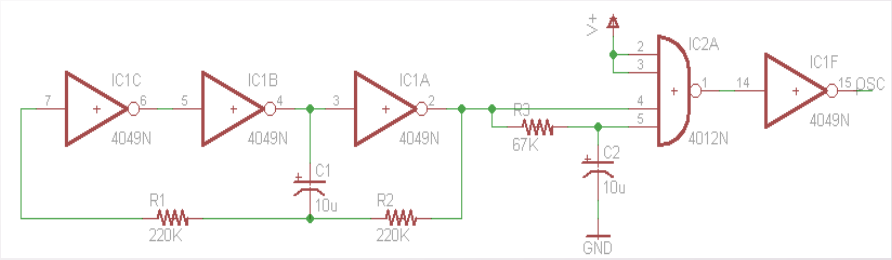
TRANSMITTER NETWORK



RECEIVER NETWORK







DEMO

- VIDEO OF CAR PARKING
- PARKING TRIAL AT CAR

ACKNOWLEDGEMENT AND REFERENCE

CSA Group. (2013). *Codes & Standards*. Retrieved from CSA Group: http://www.csagroup.org/ca/en/services/codes-and-standards

ELECTRONIC CODE OF FEDERAL REGULATIONS: Part 15 - Radio Frequency Devices. (2013). Retrieved October 16, 2013, from http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&sid=ed2208a3c3d672c5dec1d9f15c988467&rgn=div5&view=text&node=47:1.0.1.1.16&idno=47

Fairchild Semiconductors. (2013). Retrieved from Fairchild Semiconductors: http://www.fairchildsemi.com/an/AN/AN-118.pdf

ISO. (2013). Retrieved 10 17, 2013, from International Orginazation for Standardization: http://www.iso.org/iso/home.html

Nemko. (2010). *FCC Part 15*. Retrieved from Comunication Certification Laboratory: http://www.cclab.com/fcc-part-15.htm

Newelectronics. (2010, May 12). *An introduction to ultrasonic sensors for vehicle parking.* Retrieved from Newelectronics: http://www.newelectronics.co.uk/electronics-technology/an-introduction-to-ultrasonic-sensors-for-vehicle-parking/24966/

Parkingsensors.net. (2013). Retrieved from Parkingsensors.net: http://parkingsensors.net/

Wikipedia. (2013, September 25). *Parking Sensors*. Retrieved from Wikipedia: http://en.wikipedia.org/wiki/Parking_sensors

HTTP://ARDUINO.CC/EN/MAIN/ARDUINOBOARDMEGA

QUESTIONS?