

Final Report EE 595 Fall 2011, Advisor Thomas McGuire.

# RED

## Roadside Emergency Device

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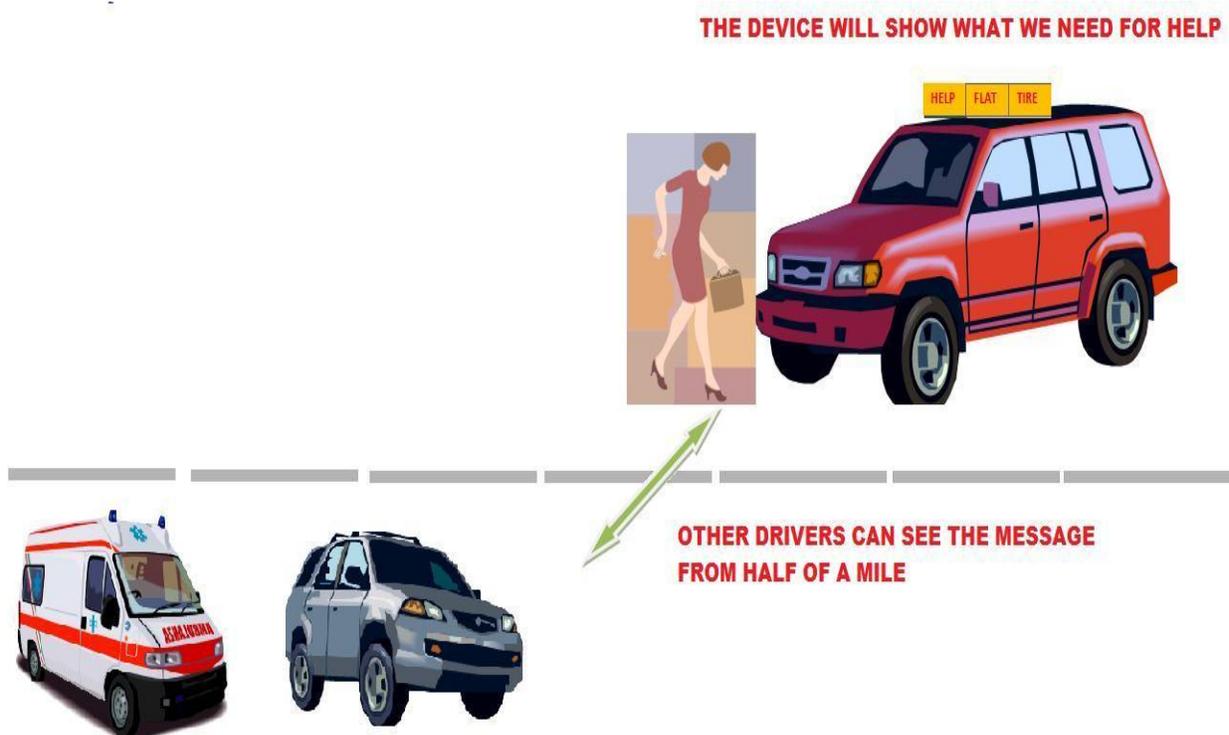
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## SECTION 1: PRODUCT SUMMARY

### 1. The Product

RED, the Roadside Emergency Device, is a foldable LED display for use on top of vehicles which are stranded alongside the roadway to communicate to passing motorists. RED will have six preprogrammed distress messages. This innovative product provides drivers with the peace of mind they desire. With RED, they know that if they are stranded on the side of a roadway, they will have a way to communicate with passing motorists for help.

### The General Picture of the Product



We tested on the brightness of the product and product met our goal.

Other drivers can see the display from half of a mile, and they can read the message within 300 feet.

## 2. How and Why Our Products Work

RED is a foldable LED message board that sets on top of a stranded car which informs passing motorists of the situation at hand. The product contains three **5x7 panels for a total length of 22" long, 7.5" height and it** will be foldable to allow easy storage inside a compact car but large enough to easily read by passing motorists on a 70 mph highway. The bottom of the device will feature strong magnets to securely attach to the roof of a vehicle. These base magnets will be covered in rubber to prevent any damage to a vehicle. There will be six preset messages within the board to display, indicating what type of help is needed. **These preset messages will read: "Call 911," "Need Help," "Flat Tire," "Out of Gas," "Car is Dead," "< < <" (this final display will simply be arrows directing traffic away** from the vehicle much like on police patrol cars or road construction crew vehicles). Along with the preset messages, a USB connection is on the sign to allow for customization of the display message or it can be ordered with specific messages. Additionally, there will be a separate AC and DC cord available for power to be sent to the device from either a cigarette lighter in a car or any traditional house outlet. The amount of energy required to operate RED will be minimal. RED is a product that will not only be functional to any user, but is compact to be easily stored underneath the seat of a car. RED is an item that brings safety and awareness to the open roads.

## 3. The Features and Benefits

- This is a portable and lightweight device
- The device has 6 pre-programmed messages
- User could create up to 30 messages.
- User could switch to different message if desired
- User can also change the pre-programmed messages by modify the program of the product
- This device could be used for many purposes beside of using for emergency cases. User can use it for open and close sign for business, etc.

Our future plan is write an application program for the device so user can change the messages in an easier way.

## SECTION 2: SPECIFICATIONS

### 1. Product Specifications:

Product Depth (in): 3/4 in  
Product Height (in): 7.5 in  
Product Width (in): 22 in  
Power input: 5V  
Display color: Blue

### 2. LED lights Specifications:

Forward voltage: 3.4 V  
Dominant wavelength: 6500k  
MCD: 10000 MCD  
Forward current: 20mA  
Reverse current: 10uA  
Power angle: 120-140 degree

### 3. 74HC595 IC chip:

Category: Integrated Circuits (ICs)  
Family: Logic-Shift Registers  
Series: 74HC  
Logic type: Shift register  
Output type: Tri-state  
Number of bit per element: 8  
Function: Serial to parallel  
Voltage supply: 2V ~ 6V  
Operating Temperature: -40 C ~ 85 C  
Mounting type: Surface mounts

For more information visit this website link:

<http://search.digikey.com/us/en/products/MM74HC595MX/MM74HC595MXTR-ND/1051605>

For data sheet visit this link

<http://www.fairchildsemi.com/ds/MM/MM74HC595.pdf>

### 4. TPIC6C595 IC Chip:

Category: Integrated Circuits (ICs)  
Family: Logic-Shift Registers  
Series: -  
Logic type: Shift register  
Output type: Standard

Number of bit per element: 8  
Function: Serial to parallel  
Voltage supply: 4.5V ~ 5.5V  
Operating Temperature: -40 C ~ 125 C  
Mounting type: Surface mounts

For more information visit this website link:  
<http://search.digikey.com/us/en/products/STPIC6C595MTR/497-3023-2-ND/634787>

For data sheet visit this link  
[http://www.st.com/internet/com/TECHNICAL\\_RESOURCES/TECHNICAL\\_LITERATURE/DATASHEET/CD00020664.pdf](http://www.st.com/internet/com/TECHNICAL_RESOURCES/TECHNICAL_LITERATURE/DATASHEET/CD00020664.pdf)

## **5. Arduino:**

ATmega328 microcontroller  
Input voltage - 7-12V  
14 Digital I/O Pins (6 PWM outputs)  
6 Analog Inputs  
32k Flash Memory  
16 MHz Clock Speed

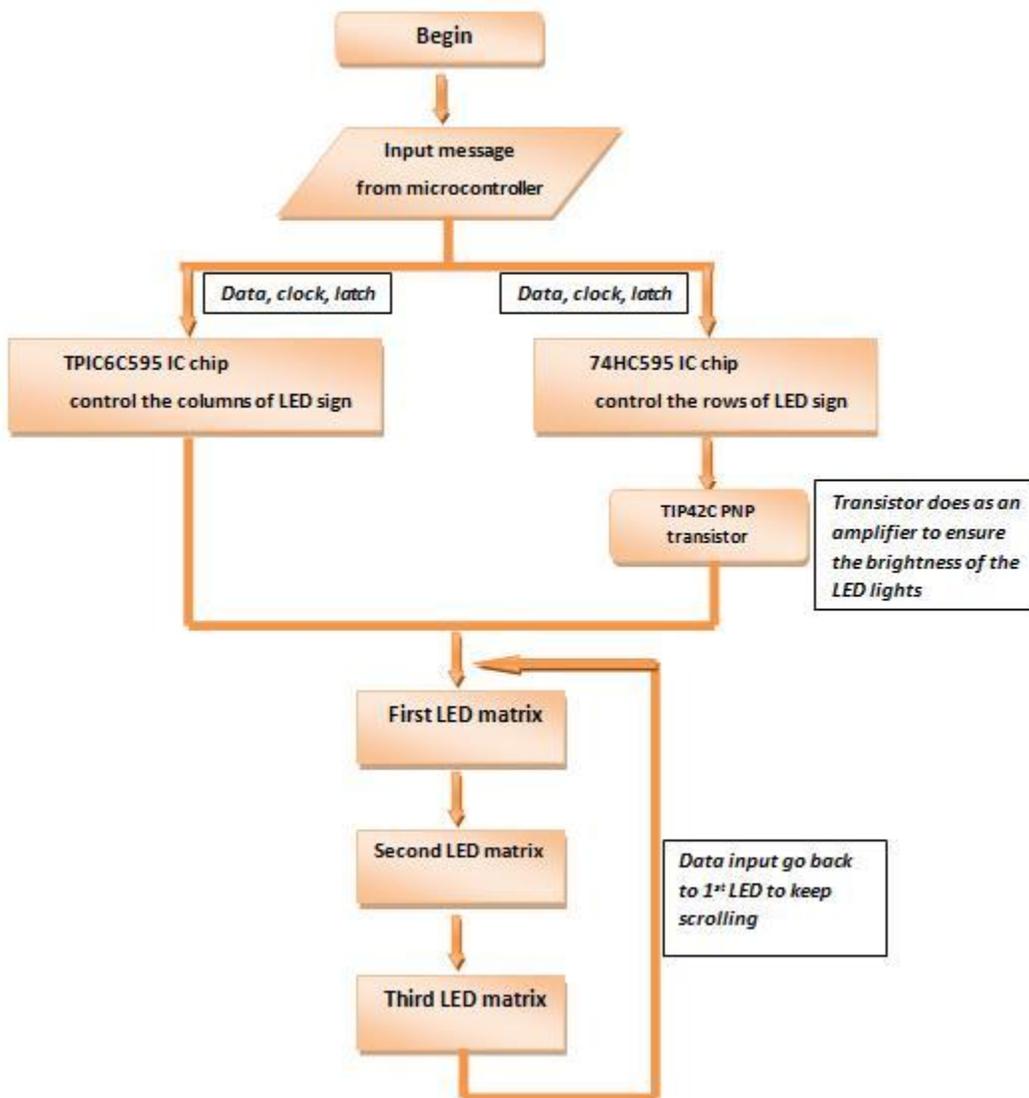
For more information please visit this link:  
<http://arduino.cc/en/Main/ArduinoBoardUno>

## **SECTION 3: USER MANUAL**

- 1- Pull the display sign out of the box.
- 2- Unfold the sign, and set it up on desired place.
- 3- Use the A/C or D/C power adapter provided, and plugs it in.
- 4- Select the message desired by pushing in the button.
- 5- Check and see if the correct message is displayed  
(ATTENTION DO NOT EXCEED 5 V DC)

## SECTION 4: FLOWCHART, CODES, AND SCHEMATICS

### Flow Chart of Product:



## The Code:

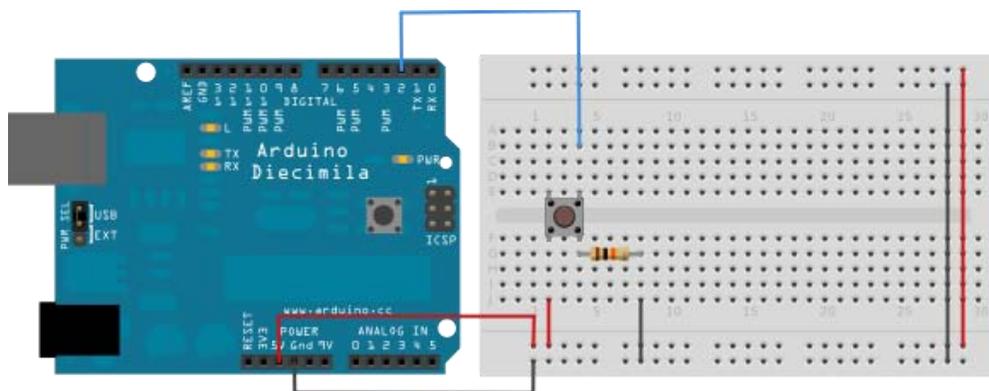
This is a brief explanation about the code:

- Define the input messages
- Define the arduino pins that will be connected to the 74HC595 and TPIC6c595 which is latch, clock, and data
- Set up the bit map for the 3 panes LED
- Define the font for the Alphabets
- Set up the output for which pins going to the IC chips
- Main function:
  - This routine takes what we setup on the bit map array and displays it on the LED matrix
  - Shift the data into the first LED panel and then shift to the second and third panel and then going back to the first LED panel
- Loop:
  - If the button is pushed, the code will read the next message that we set up in the beginning of the program and show it on the LED display.

For more about the codes please see the attachment [final\_code1.pde]

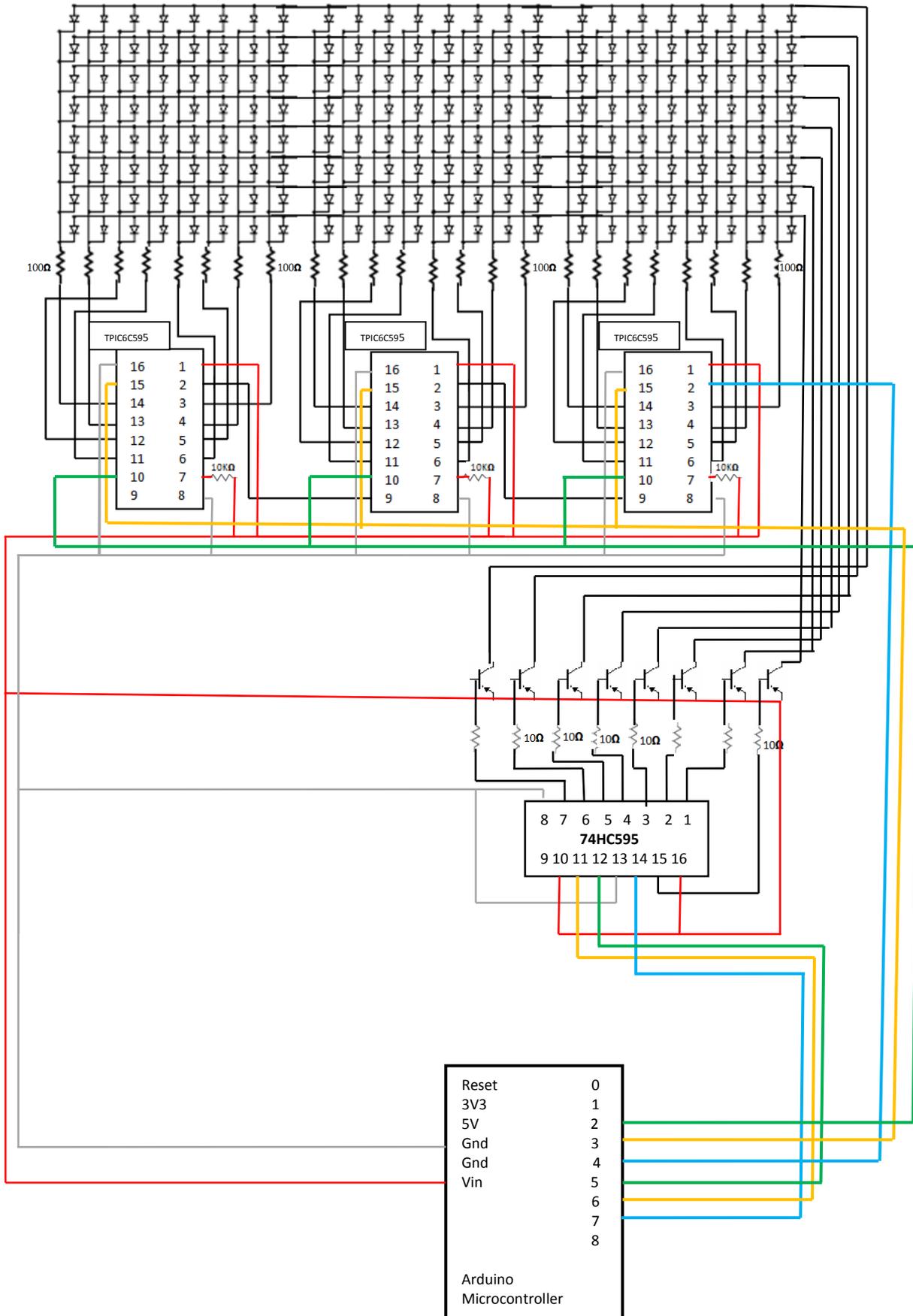
## The button

This is how we wire the push button, however instead connected to pin 2, we connected to pin 12



**Source:** <http://arduino.cc/en/Tutorial/Button>

**Schematics:**



## 74hc595 IC chip:

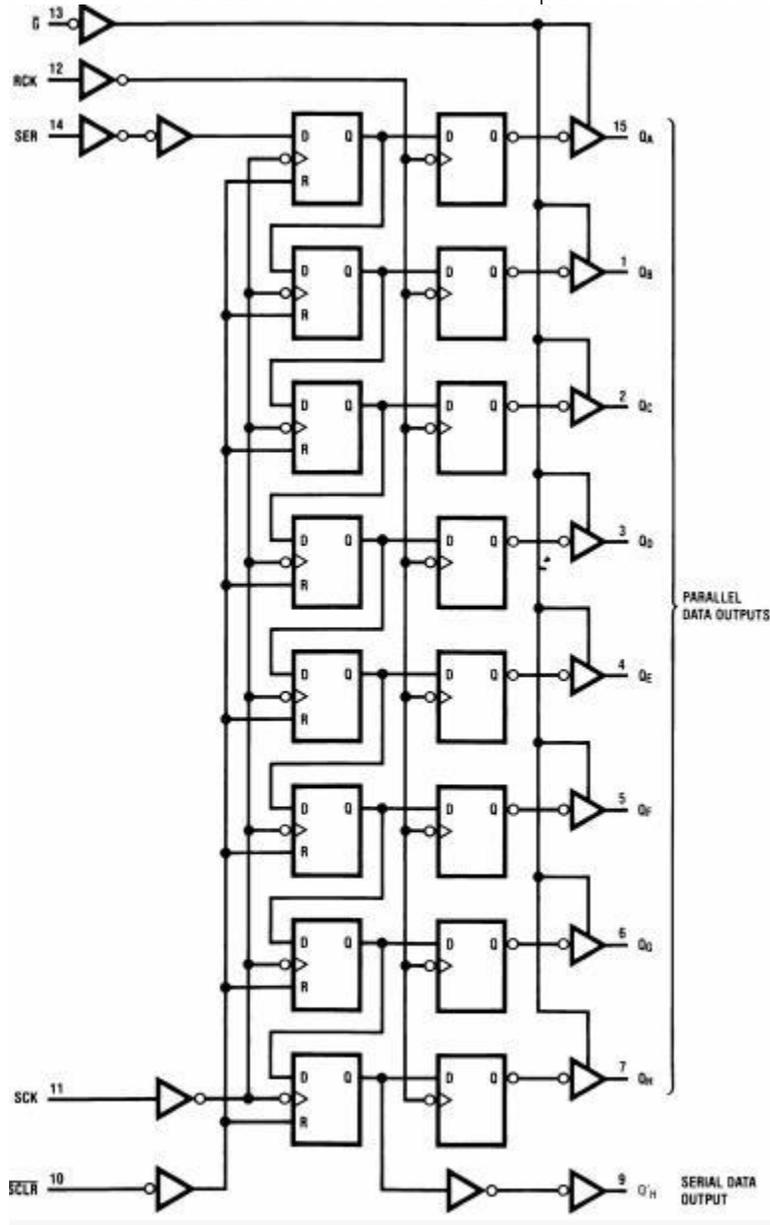
This IC chip control the 8 rows of the LED panels

The 8 rows is all the anodes of the LED in 1 row connected together

Pin 5 of the arduino is connected to pin 12 of the chip

Pin 6 of the arduino is connected to pin 11 of the chip

Pin 7 of the arduino is connected to pin 14 of the chip



Source: digikey.com



## **SECTION 5: INDUSTRY ANALYSIS**

The roadside assistance industry is a very large market. There are service providers that assist motorists 24/7 with virtually any problem they may have on the road. Additionally, there are also roadside emergency kits that provide several items to keep the motorists safe and assist in getting their car running and back on the road. Several of the roadside emergency kit companies, however, are more heavily invested in other areas outside the roadside industry. Roadside emergency kits are only a portion of their business. The roadside industry is important because it affects every licensed driver and every car at one point in time in some way, whether they have the services or not.

Competition in the roadside assistance industry is well established and exclusive. Many roadside emergency kits are provided to large service providers from privately held manufacturing companies. Because of this, there are barriers to entry in this market. However, putting these kits together and offering them to the public is not difficult, enabling anybody to have peace of mind without the hassle of being a member of an organization or not.

### **1. Strategic Opportunities**

Introducing an innovative and fresh product that has the potential to replace many different items that are typically included in roadside emergency kits is a large advantage. There are many kits that are sold individually on retail shelves in stores such as AutoZone and even in Wal-Mart. Being able to bypass this model of individual sales and to sell to companies in large quantities provides an opportunity for economies of scale as well as penetration in a large capacity. We anticipate AAA, Allstate, as well as roadside kit manufacturers to be potential organizations interested in purchasing RED in these large quantities. We also anticipate organizations that manage fleets of cars to be potential customers. It is important to recognize that safety amongst all drivers is imperative whether the economy is up or down. People will always be driving and, even if gas prices are high, motorists will still be concerned about their safety.

### **2. Competitor Analysis**

There are many products and services within this industry. The two primary services are AAA and OnStar, and we believe RED is a compliment to all of these. While a motorist may pay for a roadside assistance service such as AAA or OnStar, they are still stranded alongside the road until the service providers arrive. Even if a motorist has a roadside emergency kit in their car, they could still use RED as a supplement to communicate to drivers passing by. Law enforcement agencies are always willing to help motorists in need, but they are not always able to be there right away. RED may also be a way to help get the attention of law enforcement and to notify them that help is needed. Motorists could use the RED as they await

a local law enforcement officer. Most motorists are able to call for help with a cell phone, but service is not always available in rural areas. Additionally, most motorists who find themselves stranded alongside the road have cell phones with them but the battery has died and the cigarette lighter in their car to charge the battery **doesn't work**. **In all of these situations, RED could be used by motorists as a simple warning device to alert drivers of the danger ahead and a means to communicate with fellow motorists.**

### **3. Market Description**

The roadside assistance industry's target customers are vehicle drivers who are looking for the added reassurance that if they are stranded alongside a highway or road, they have the tools or assistance they need. There are over 208 million licensed drivers in the United States alone. Over three million highway miles are traveled each year by these drivers and AAA reported in 2010 that they would assist 1.4 million stranded AAA members over the holiday season alone.

### **4. Market Demographic**

Consumers seeking roadside assistance, either in the form of a service such as AAA or OnStar or a roadside emergency kit, are remarkably diverse. AAA's member profile in 2007 is an example of this diverse demographic. The average age of a AAA member is 52 with 51% of their members being between the ages of 45 and 64. 22% of their members are between 18 and 44 while 28% are 65 or above. Gender is almost split evenly with 47% being male and 53% being female. Household income is very diverse as well with a wide spread of incomes primarily below \$100,000.

Given this information, RED aims to target men between the ages of 45 to 64. **While AAA's demographics show slightly more women than men, we believe that men will better respond to RED given its technology-based and gadget nature.** Additionally, we believe that the 45 – 64 age group is appropriate as this age group is more likely to be concerned about roadside safety. This group is also more willing to pay for roadside assistance with similar price points as RED.

### **5. Strategic Position**

RED's unique role in the marketplace is that of an innovative and complementary product in the roadside assistance industry. Currently, we are the only provider of an LED display for use atop a vehicle in an emergency or stranded position. RED is an excellent complimentary product to all roadside assistance services and products whether it is AAA or a roadside emergency kit. This unique position allows RED to become an integral player in all aspects of the roadside assistance industry

## SECTION6: RISK ASSESSMENT AND PRODUCIBILITY

### 1. Risk Assessment

The Product has four principle risks.

**First**, many vehicle owners and drivers do not believe that they will be the ones stranded along the highway and, therefore, do not have a need for a roadside assistance product or service. We will approach this primary risk through our strategy of introducing RED through established roadside assistance providers. This allows us to reach consumers who are already concerned with being stranded alongside the roadway and, therefore, allows us to focus on selling the product itself rather than potential problem for drivers.

**Second**, imitation products could be created by current roadside assistance product manufacturers or service providers. As the first mover, however, RED has the opportunity to minimize this risk through its overall strategy of penetrating the market through established products and services. By targeting customers of existing roadside assistance products and services, RED is able to penetrate the market much more quickly than any emerging competitor.

**Third**, there are regulatory requirements in various jurisdictions and municipalities governing LED signage alongside roadways. For example, the City of Wichita has established regulations requiring that LED lights be a certain brightness after dusk. Regulations such as these are difficult to comply with through proper product design. With thorough research and collaboration, RED will be compliant with all regulations within the United States as well as any other governmental state in which the product enters.

All the components used in the development of RED, like the A/C, D/C, power sources, like all resistors, and transistors as well as LED lights have been tested individually by several deferent testing agencies, like (UL), (CE), (FCC), (MOM), etc.

**Fourth**, consumer safety is a concern when stranded motorists must exit their vehicle to place RED on top of their vehicle. We already have and will continue to collaborate with law enforcement officials to gain perspective and seek insight in making it the safest product possible. Interviews with law enforcement have already proven to be extremely useful in developing RED as a safe roadside product for both stranded drivers as well as passing motorists. These interviews have suggested that the products would provide additional support to law enforcement in identifying stranded motorists alongside the road. Additionally, we believe that RED provides added safety to users in distress by increasing their visibility to the passing public.

RED is a product that can be a revolutionary substitute for the current products on the market today. The roadside emergency industry covers a wide

breadth of people; in just about every demographic. He believes with the dedication of management within RED and the viability of the product, RED could dominate the market, revolutionizing the way people feel

## **2. Producibility**

If we order in large amount we could have discount from the distributor:

74HC595 IC chip: \$ 0.123 per unit for order of 10,000 units and up  
TPIC6C595 IC chip: \$0.528 per unit for order of 10,000 units and up  
10 ohms resistor: \$0.009 per unit for order of 1000 unit and up

In our current design we use the Arduino Uno ATmega 328 in the product; however in our future product we will using the main IC chip in the Arduino only, that is definitely will reduce the cost to build the product at least 20 dollars. Along with the advantage from capability of deducing the cost our product is divided into 3 different panels connected together with hinges that would make the device easier to be built rather than 1 whole piece.

For right now our handmade product cost around \$55.00, but we believe if we order components in large quantities and not use the whole arduino, the estimated cost of the finished product will be \$49.99, if we can manufacture it for less in large quantities. Our goal is to be able to sell it to large chain stores like Auto zone, Wal-Mart, but our main goal is to be able to introduce it to car manufactures, like GM, Ford, Toyota, Nissan, and other, we think this product can be included as a free complementary aid package.

## SECTION 7: BILL OF MATERIALS

Item	Ref	Qty	Desc.	Mfg	Part No	Source	Price Per unit
1	74HC595	1	IC SHIFT REGISTER 8-BIT 16-SOIC	FAIRCHILD SEMI-CONDUCTOR	MM74HC595MX	DIGIKEY	0.142
2	TPIC6C595	3	IC SHIFT REGISTER 8-BIT 16-SOIC	STMICROELECTRONIC	STPIC6C595MTR	DIGIKEY	0.58
3	100 OHMS	24	100 OHMS REGISTER	PANASONIC-ECG	ERD-S2TJ101V	DIGIKEY	0.00589
4	10K OHMS	3	10K OHMS REGISTER	PANASONIC-ECG	ERD-S2TJ114V	DIGIKEY	0.00589
5	10 OHMS	8	10 OHMS REGISTER	STACKPOLE ELECTRONICS INC.	CF18JT10R0	DIGIKEY	0.09
6	LED	192	LED LIGHTS			GOODLUCKBUY.COM	0.1613
7	PUSH BUTTON	1	SWITCH PUSH DPDT 0.2A 14V	PANASONIC-ECG	ESB-33133	DIGIKEY	1.36
8	USB CABLE	1	STANDARD A-B	PANASONIC	USG-3604	DIGIKEY	2.15
9	ARDUINO	1	UNO ATMEGA328	SMART PROJECT	UNO ATMEGA328	SPARKFUN	29.99
10	TRANSISTOR	8	TRANS PNP GP 100V 6A	FAIRCHILD SEMI-CONDUCTOR	TIP42C	DIGIKEY	0.67

**Direct Links to go to these distributors website:**

<http://www.digikey.com/>

<http://www.goodluckbuy.com/5050-warm-white-smd-led-plcc-6-3-chips-9000mcd.html>

<http://www.sparkfun.com/products/9950>

## SECTION 8: HISTORY AND SUMMARY

Millions of motorists are stranded yearly on the side of the road, unable to communicate with the vehicles passing by. Many times these passing motorists are able to assist the stranded **driver, but they don't stop to help because they are** unaware of the need. Having a way to communicate with the passing motorists would provide an opportunity for stranded drivers to receive the assistance they need. Safety and security on the road are top priorities for drivers, who consequently choose to pay for roadside assistance services. These people, numbering over 50 million, subscribe yearly for the peace of mind when trouble occurs on the road.

The fear of being stuck on the side of the road plagues everyone regardless of having the security of a cell phone, roadside emergency services, or knowledgeable people in the car. Many times, there are willing and able people to help the stranded motorists but do not stop to help because they are unaware to what the problem is. The solution is RED, the Roadside Emergency Device. This device will revolutionize the way motorists think and feel about driving alone, or being stranded alongside the road.

RED has been developed by three Electrical Engineering students in Wichita. All three of us have studied at Wichita State University College of Engineering. We are all highly committed to RED and plan to utilize our knowledge and experience to ensure **RED's success**.

## APPENDIX

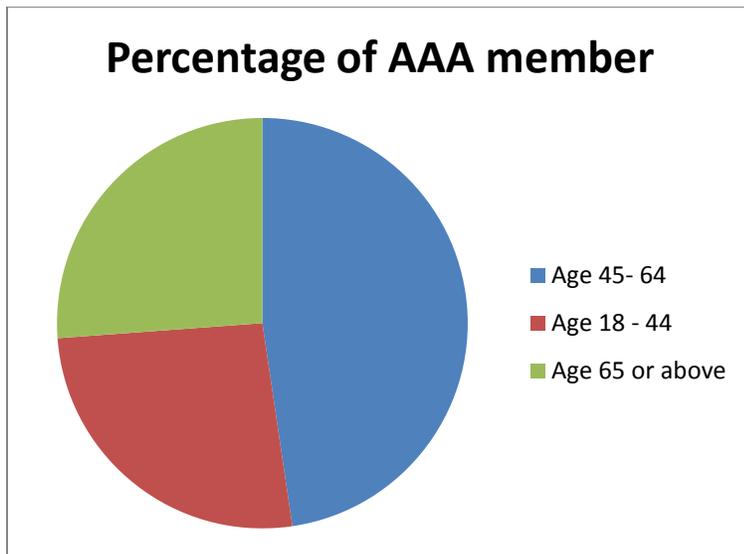
### Symbol and unit

**V** .....Voltage

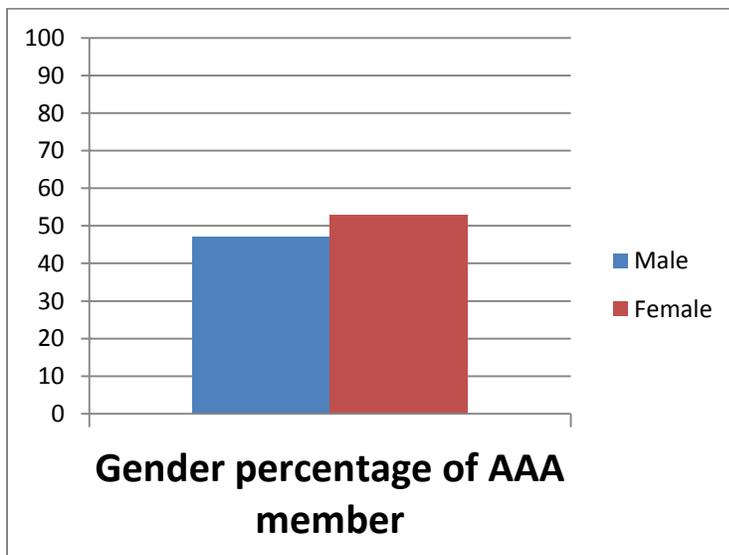
**C** .....Celsius degree

**A**.....Ampere.....Current

### Chart: percentage of member of AAA member



### Chart: Gender percentage of AAA member:



Source: based on AAA website data - 2007

