



Safety and Communication System (SCS) for passengers in railroad transportation

Enhancing Laboratory
Education in GK-12

XIAOYANG LIN
EATHAN HSU
EDUARDO SUESCÚN

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SAFETY COMMUNICATION SYSTEM (SCS) - outline

- 1. Introduction**

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 - 2.1 Automatic stops in train stations**
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Introduction

Railroad safety programs have saved tens of thousands of lives and prevented hundreds of thousands of injuries
(McDonald, 1993).

- Train accidents **rates** have fallen 62.8%,
- track-and equipment-related75.2%,
- in-service deaths for railroad employees have been reduced more than 46%. (FRA, 2008)

- Today trains are longer, faster, and heavier.
- The higher speeds and heavier trains the greater potential of accidents

Rail safety improvement act of 2008

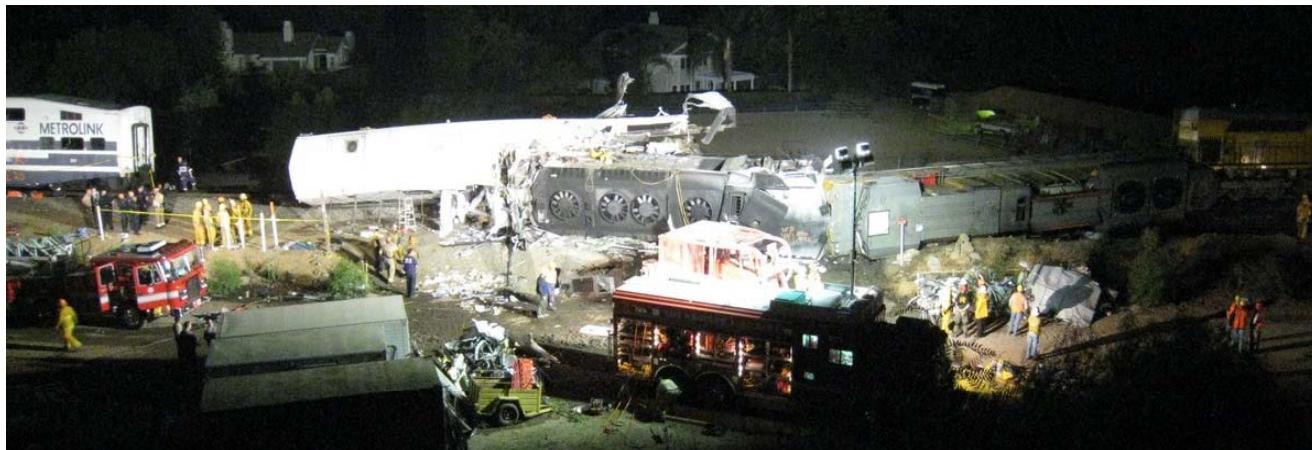


Positive Train Control (PTC) system

It integrates command, control, communications, and information systems to manage train movements with safety, security, precision, and efficiency.

It is estimated that by 2020, 20,000 locomotives and 100,000 miles of track would be equipped with PTC.

Chatsworth - Accident, 2008



National transportation Safety Board (2008)

Two trains, Union Pacific and Metrolink

The lack of attention by one of the train drivers allowed for the fatal accident in Los Angeles, CA



Main Objectives

- *To develop a simple, affordable, and **reliable** rail road safety and traffic control*
- *To apply mechatronic tools to demonstrate the **accuracy** of the rail road setup and all variables.*
- *To bring elemental mechatronic concepts for **GK-12 Educational environment***

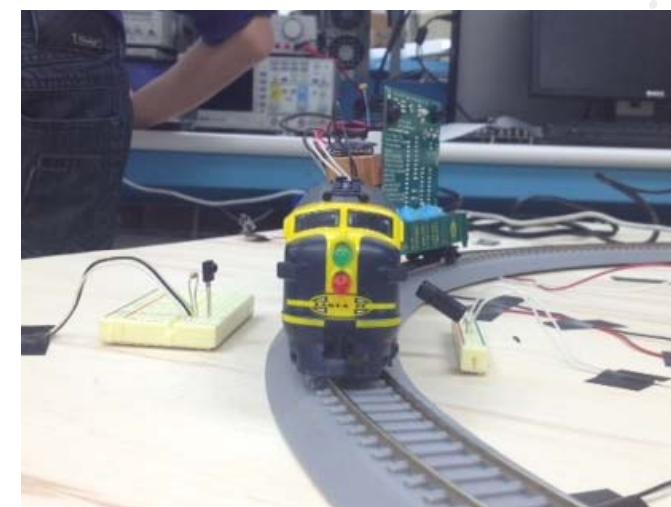
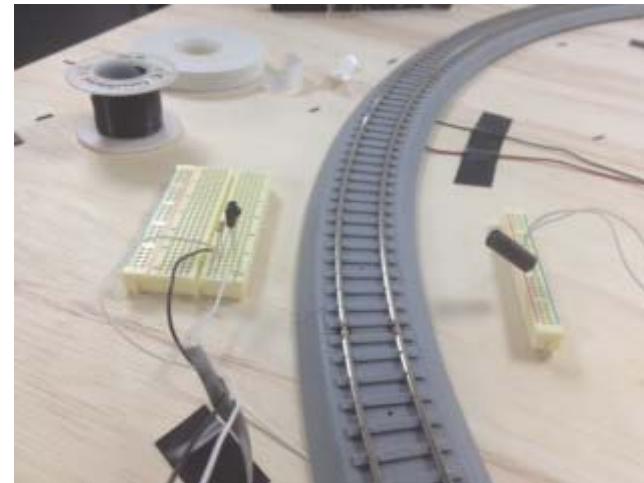
The concept of the Safety and Communication system (SCS) in Railroad Transportation

1. Educational tool to manipulate a simple railroad system
2. Basic concepts of electricity, mechanics, electronics (Mechatronics) to promote Science in GK-12 Education
3. SCS includes the following capabilities:
 - Automatic stops in train stations
 - Communication system by Twitter
 - Light system
 - Crossing intersection safety system
 - Track switching

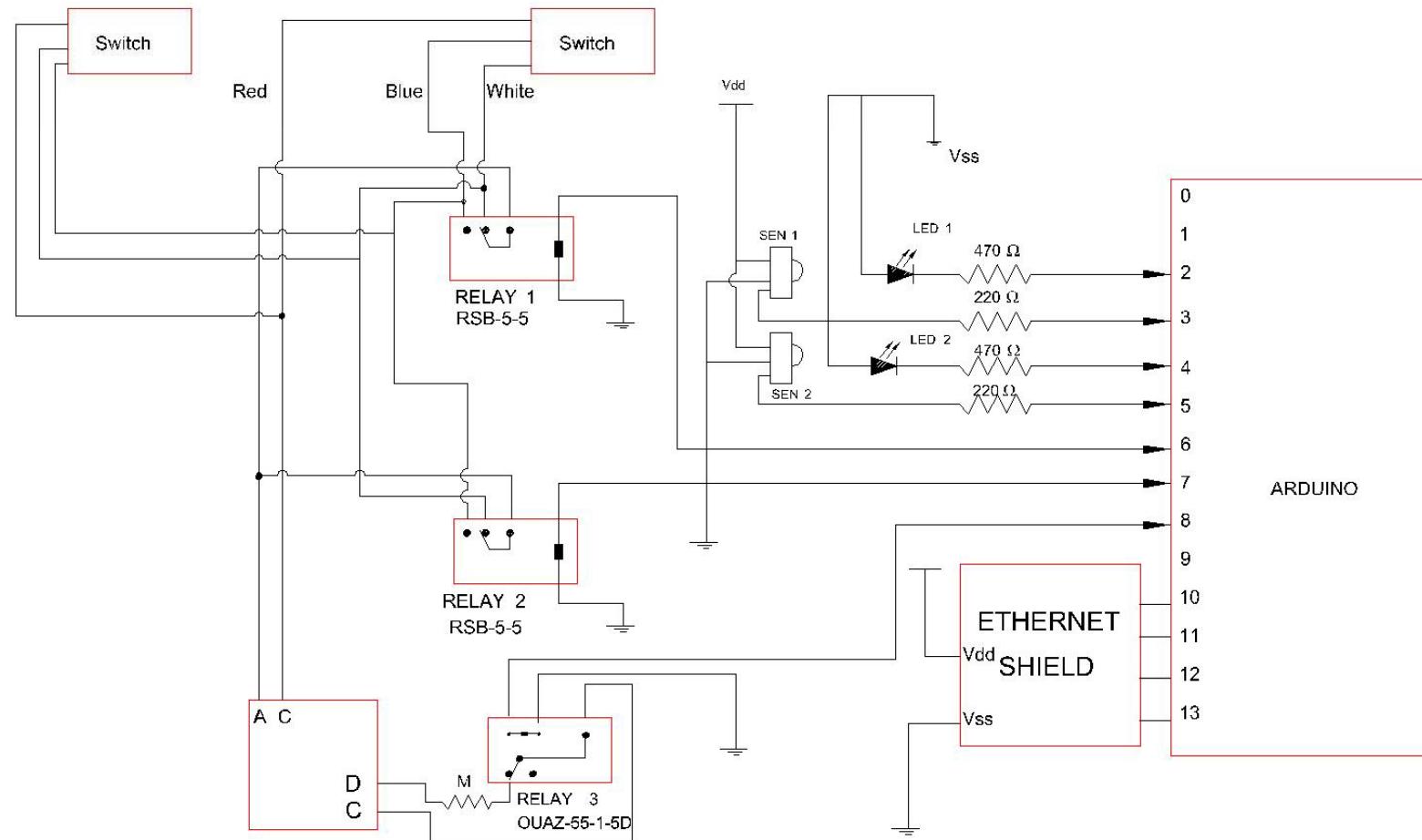


2.1 Automatic Stops in stations

- 1. Infrared beam is made by an IR sensor and LED.**
- 2. When trains crosses the beam they break it and the Arduino Microcontroller automatically stops the train.**
- 3. After a desired time train starts running again to approach the next station**



2.5 Automatic stop systems

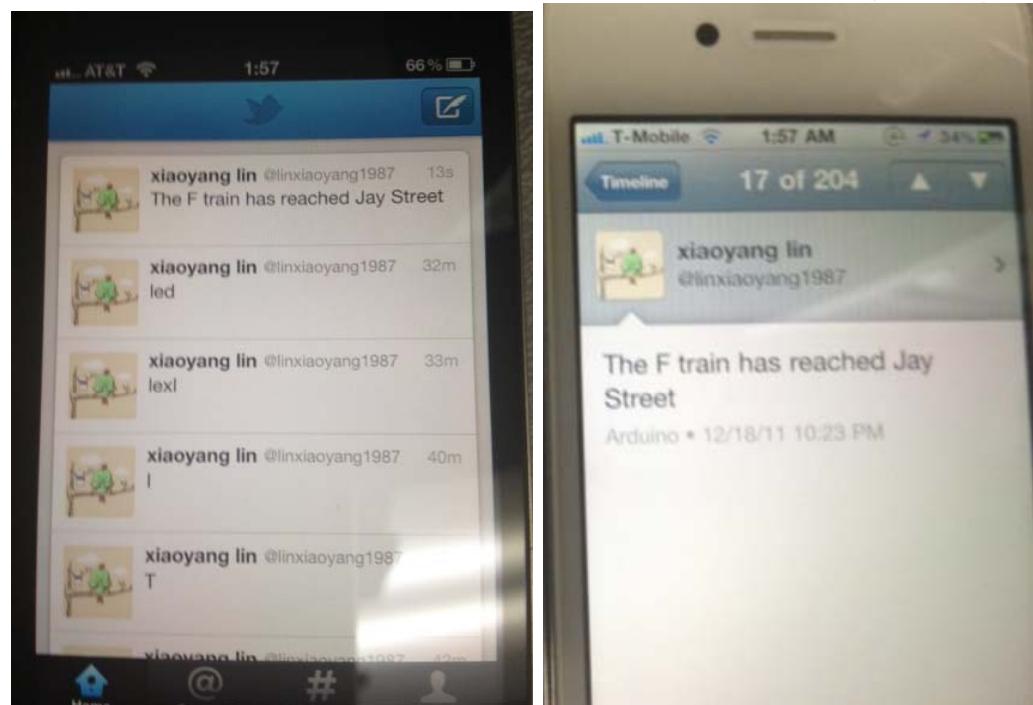


Communication system by Twitter

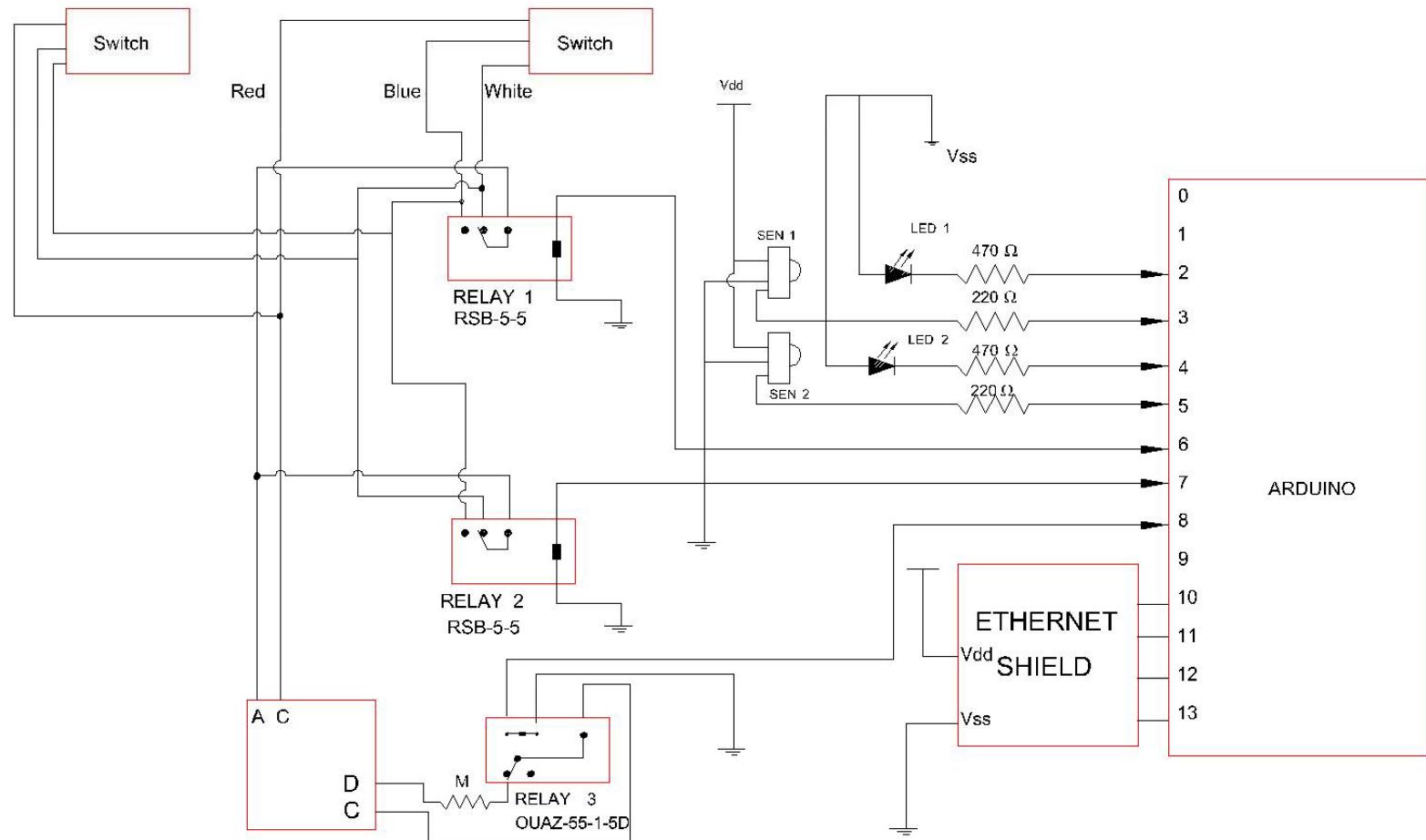
1. Managed by Arduino Microcontroller

2. Follow Lin on twitter :

@linxiaoyang1987



Communication system by Twitter

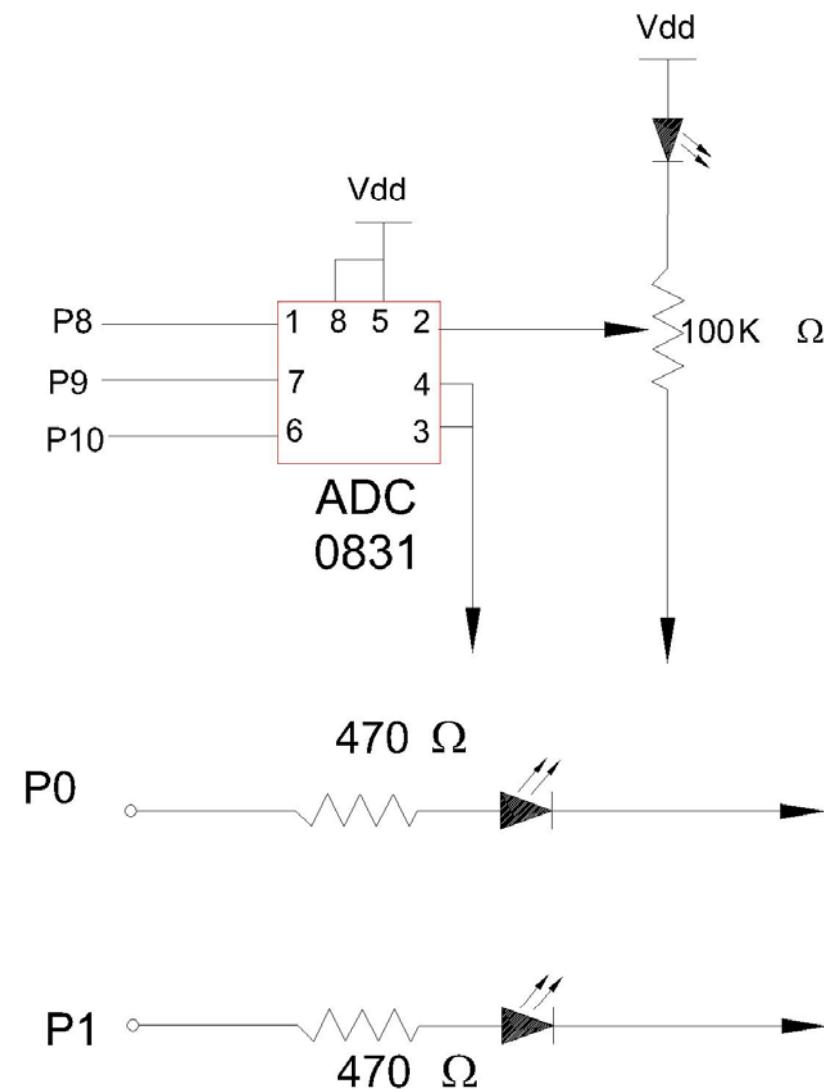


Light System

1. Controlled by **BASIC STAMP** microcontroller.
2. Automatically lights are turned on during dark areas.
3. Lights also have two labels (Green and Red), and turn on and off depending on the environment light

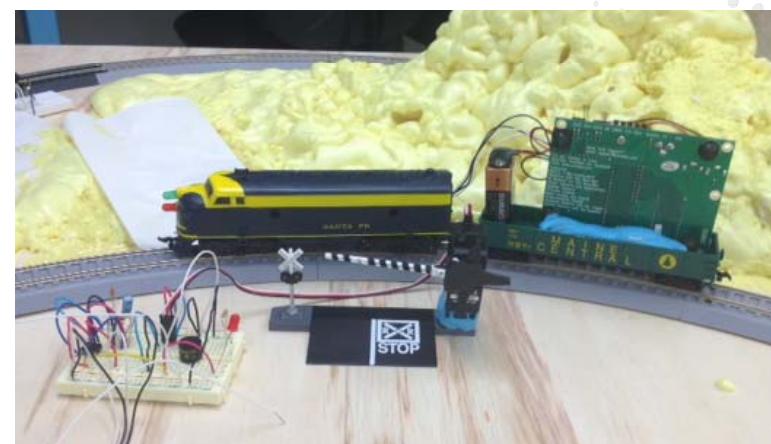
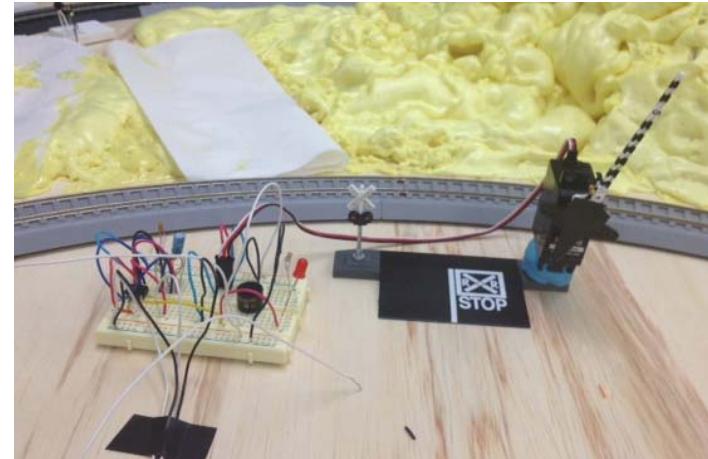


Light System - circuit

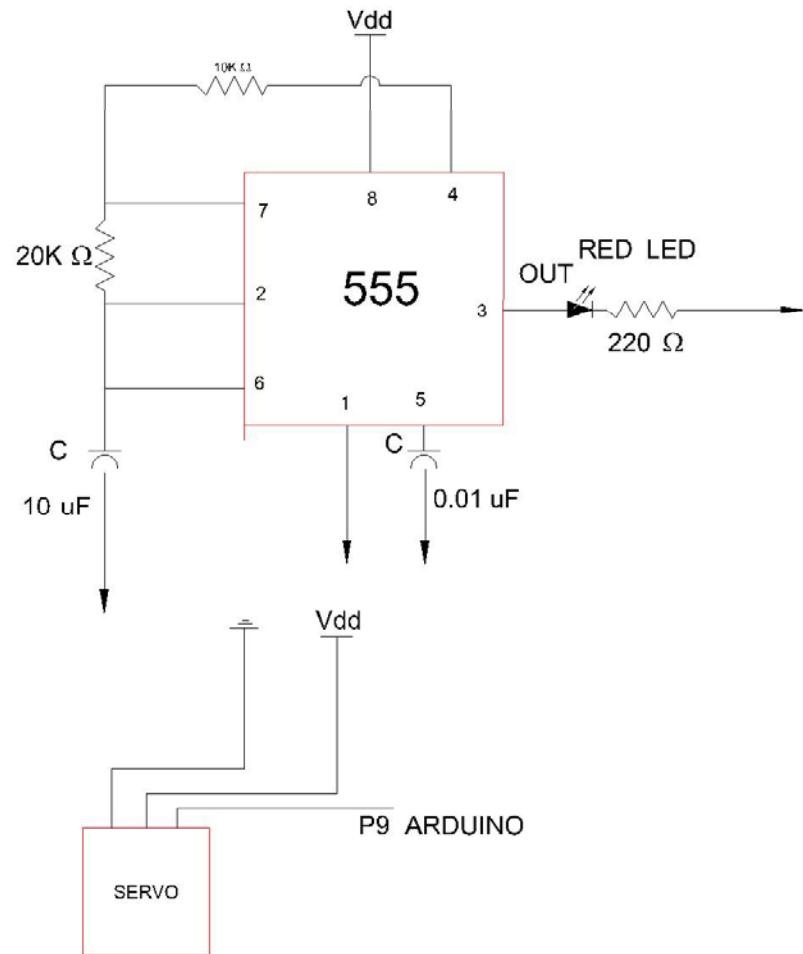


2.4 Crossing intersection safety system

- **Managed by Arduino microcontroller**
- **One servo-motor is included as actuator for the roadway gate**
- **Red light is used for warning vehicles**

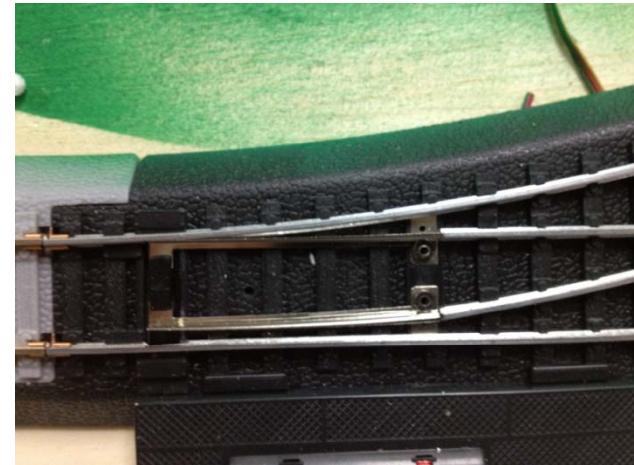


Crossing intersection safety system

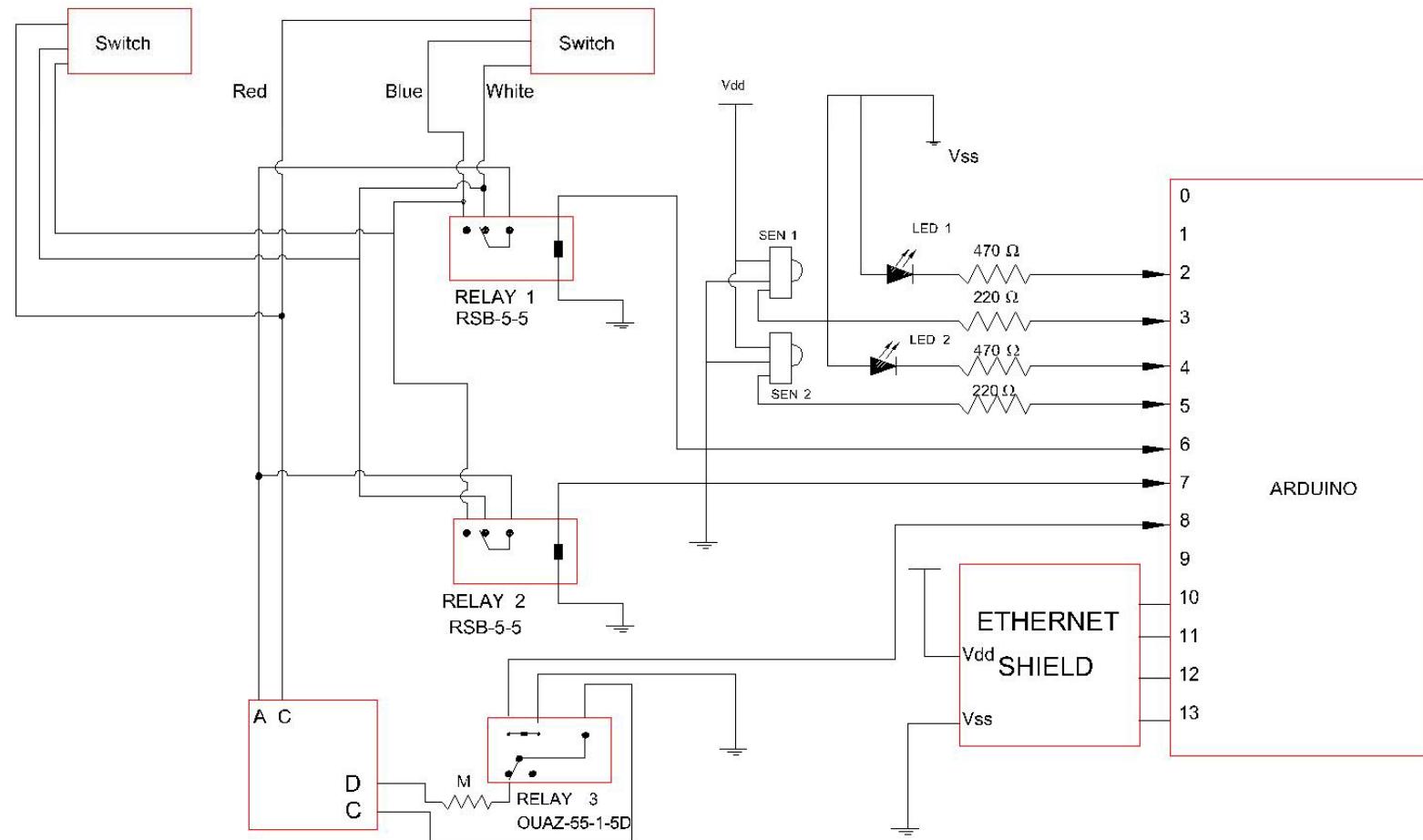


Track switching system

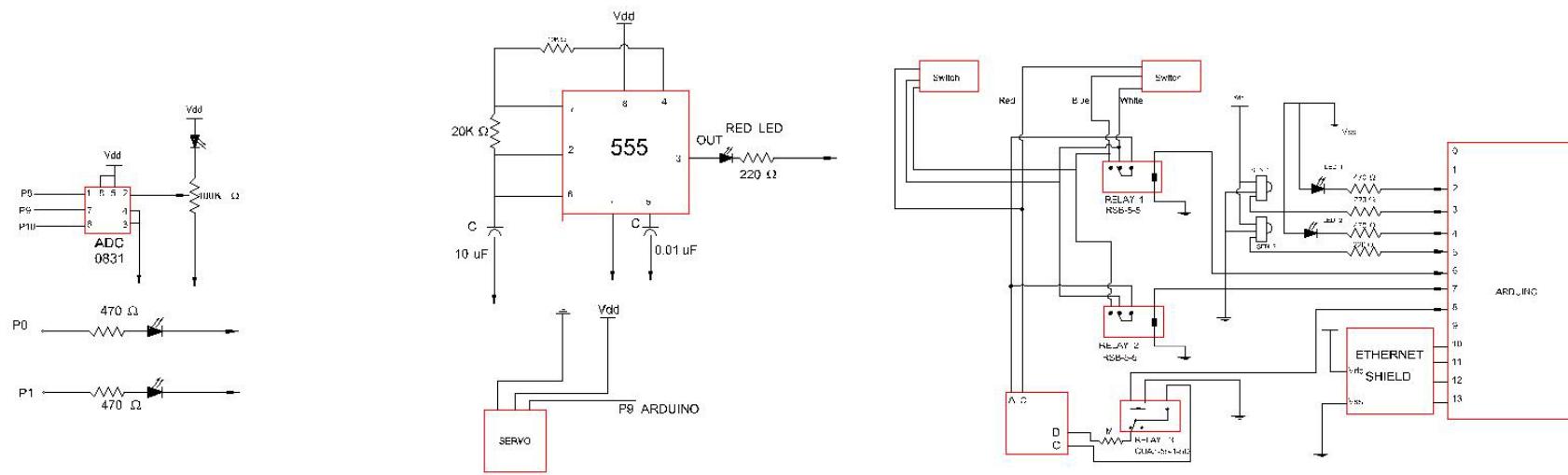
- Managed by Arduino microcontroller
- Two relays control tracks switching



Track switching system



Overall circuit



Bill-of-materials, prototype cost, cost analysis for mass production



Item No	Item Description	Price per unit (\$)	Quantity	Total price (\$)
1	Basic Stamp 2 microcontroller	99.99	1	99.99
2	Arduino microcontroller	29.95	1	29.95
3	HO-scale train plus railway tracks	60.00	1	60.00
4	Playwood 4'x6'x1/2"	15.00	1	15.00
5	Infrared sensor	3.00	2	6.00
6	Photoresistor	1.00	2	2.00
7	555 timer	1.99	1	1.99
8	Potentiometer	0.50	1	0.50
9	LED	0.10	5	0.50
10	Wire	0.05	40	2.00
11	Tape	4.00	1	4.00
12	Screws	0.50	4	2.00
13	Resistor	0.15	10	1.50
14	Relay	4.00	3	1.20
15	Battery	2.99	1	2.99
16	Ethernet shield	79.99	1	79.99
17	Servo	24.99	1	24.99
18	Spray Paint	8.50	1	8.50
	Total Cost			341.1

Advantages and disadvantages

ADVANTAGES

- **Straightforward model to manipulate and understand mechatronic concepts, and support GK-12 Education while having fun**
- **Two microcontrollers included, which allow user to deal with two main educational microcontroller families**

DISADVANTAGES

- **The prototype is not comprehensively presenting the all situation in real world.**

Acknowledges

The authors would like to thank the assistance of Professor Vikram Kapila . The authors would further like to acknowledge thoughtful ideas regarding scale-trains operation Dr Alex Sidelev from Civil Engineering Department.

QUESTIONS?

THANKS