Crossing Guards – Theory of Operation:

1) Upon first application of power, the control logic will reset. The microcontroller state machine will enter the “initialization” state. The lights and bells will be turned on, the gate motor direction relay will be set to “up”, and the gate motor power control relay will be activated for 13 seconds. After this time, all relays, lights, and bells will be deactivated.

2.0) The gate down/up cycle begins when the track occupation sensor line is pulled low. This line must remain low for 0.5 seconds in order for the micro controller to detect the change, and “trigger” the start of the cycle.

2.1) Upon the “trigger” event, the bells and lights will be activated 3 seconds prior to the gates being lowered.

2.2) The motor direction relay is then set to “down”.

2.3) The motor is activated for 13 seconds. Power to the gate motor will be interrupted (cut off), by the actuator limit switches when the gate arm reaches the max down position.

2.4) The gates will remain in the down position for 30 seconds.

2.5) Should the track occupation sensor “retrigger” during the down/up cycle, the gate down count will reset the 30 second count.

2.6) Once the gates have been down for the max duration, the gate motor control relay will be set to “up”.

2.7) The motor will then be activated for 13 seconds, which will drive the gates to the up position. Power to the gate motor will be interrupted (cut off), by the actuator limit switches when the gate arm reaches the max up position.

2.8) Once the gate arms are in the up position, the lights and bells will be turned off.

Crossing Guards – Actuator Motor Operational Notes:

1) The linear actuators that control the up/down movement of the gate arms are protected by limit switches. Power to the drive motor will automatically be cut when the actuator is fully extended (gate down), or fully retracted (gate up).

2) The gate motors are protected from over heating by built in thermal switches. These cannot be manually reset. If the motors overheat, they will automatically be disabled and remain in this state until they cool down. This could leave the gates in the “down” state.

3) The actuator motors are rated at a 10% duty cycle, and cannot run continuously. When lowering or raising the gates, the actuator motor will run for 13 seconds. Thus one complete up and down cycle will total 26 seconds (13 down, 13 up). For every down/up cycle the motors must cool for 260 seconds (4.33 mins).

4) Should the motor duty cycle be exceeded, the motors will be left in the up state, however the lights and bells will continue to function. Once the duty cycle is within normal limits, gate operations will continue.

Park Train Crossing Guard Schematic		
Chuck Hardt	05/08/16	Rev: 1.04

12 VDC
Power Supply

J1

+12 VDC

CPU_GND

J2

+12 VDC

Left Light

Right Light

Motor On

Motor Dir.

CPU GND

20 Amp

+12 VDC

Motor Auto/Off
Override

Up (R)

Down (R)

From
Loading
Platform

Up

Down

120 (N)

GND

120 (H)

Motor On

Motor On/Off
Dayton 1EJH2

Motor On
Override

Down (R)

Up (R)

Motor Dir.

Motor Up/Down
Dayton 1EJH2

Motor Up
Override

R

R

(Black)

(White)

(Red)

(Green)

(Black)

(Black)

(Red)

(Red)

Extend
Limit

Retract
Limit

Down

Up

Starting
Cap

(White)

(Black)

(Red)

(Green)

(White)

(Black)

(Red)

(Green)

M

Duff-Norton Linear Actuator
120 VAC

Neutral (White)

Down (Black)

Up (Red)

MTR_GND (Green)

Neutral (White)

Down (Red)

Up (Red)

MTR_GND (Green)

+12 VDC

Left Light

Right Light

R

R

(Black)

(White)

(Red)

(Green)

(Black)

(Black)

(Red)

(Red)

Extend
Limit

Retract
Limit

Down

Up

Starting
Cap

(White)

(Black)

(Red)

(Green)

(White)

(Black)

(Red)

(Green)

M

Remote Signal Junction Box

Duff-Norton Linear Actuator
120 VAC

Park Train Crossing Guard Schematic		
Chuck Hardt	05/08/16	Rev: 1.04

J1
+12 VDC
CPU GND
C1 100uf 16V
C2 0.1 uf 16V
LM317T
8.5 VDC
Power On LED
D9
R11 470 Ω ¼ W
R12 210 Ω ¼ W
R13 1500 Ω ¼ W
C3 100uf 16V
C4 0.1 uf 16V

Remote Control Module
2 x12v 10A Single Channel

NC
COM
NO
+12
GND
J3
Trigger
+12 VDC
CPU GND

This is a "low" going event trigger.

D10
R10 210 Ω ¼ W
LED
R9 330 Ω ¼ W
Q5 2N2222

Sparkfun
MP3 Trigger

J4
Bell
Audio Out +
Audio Out -
+12 VDC
CPU GND

+12 VDC
R14 330 Ω ¼ W
R15 560 Ω ¼ W
Input
Q6 2N2222

Arduino Uno
VIN
+5V
IO-0
IO-1
IO-2
IO-3
IO-4
IO-5
IO-6
IO-7
IO-8
IO-9
IO-10
IO-11
IO-12
IO-13
AREF
Input LED
Bell

Audio
Amplifier
Canakit
10 W
Amp
J5
Audio In +
Audio In -
Speaker +
Speaker -
+12 VDC
CPU GND

Electronic
Bell
Speaker
8Ω 3W

J2
+12 VDC

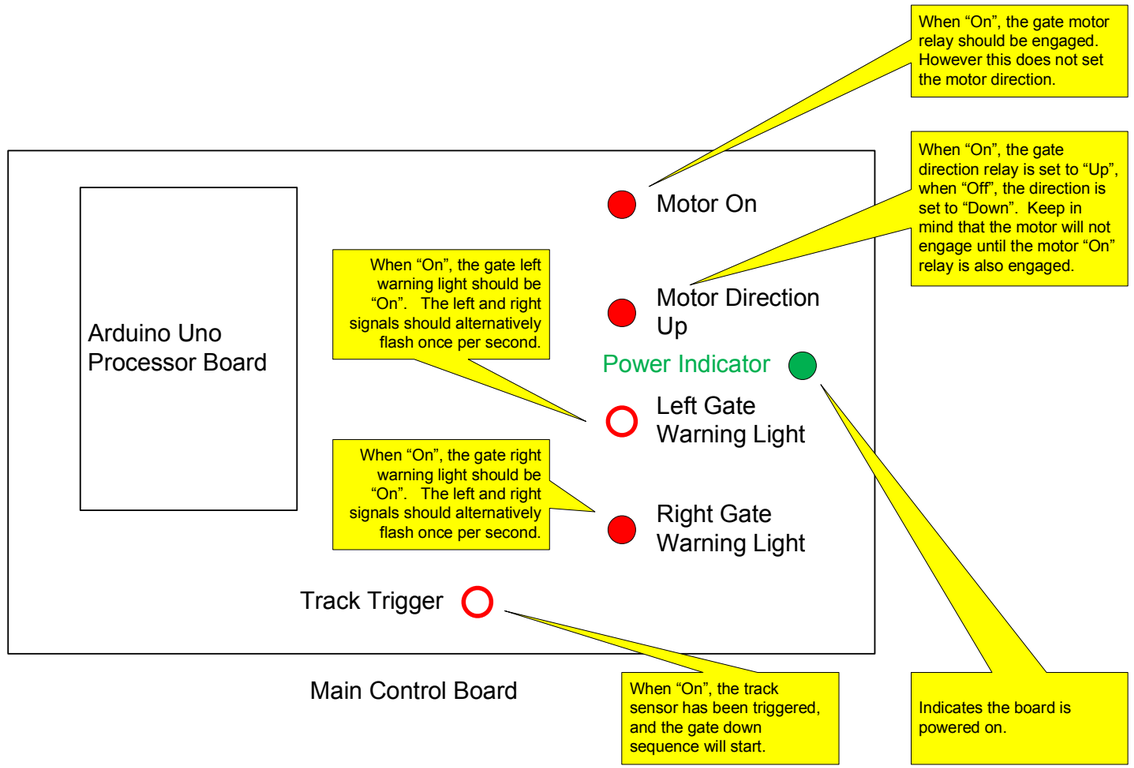
D5
D1 1N4001
R1 560 Ω ¼ W
Motor On
Q1 TIP3055
R5 210 Ω ¼ W

D6
D2 1N4001
R2 560 Ω ¼ W
Motor Dir.
Q2 TIP3055
R6 210 Ω ¼ W

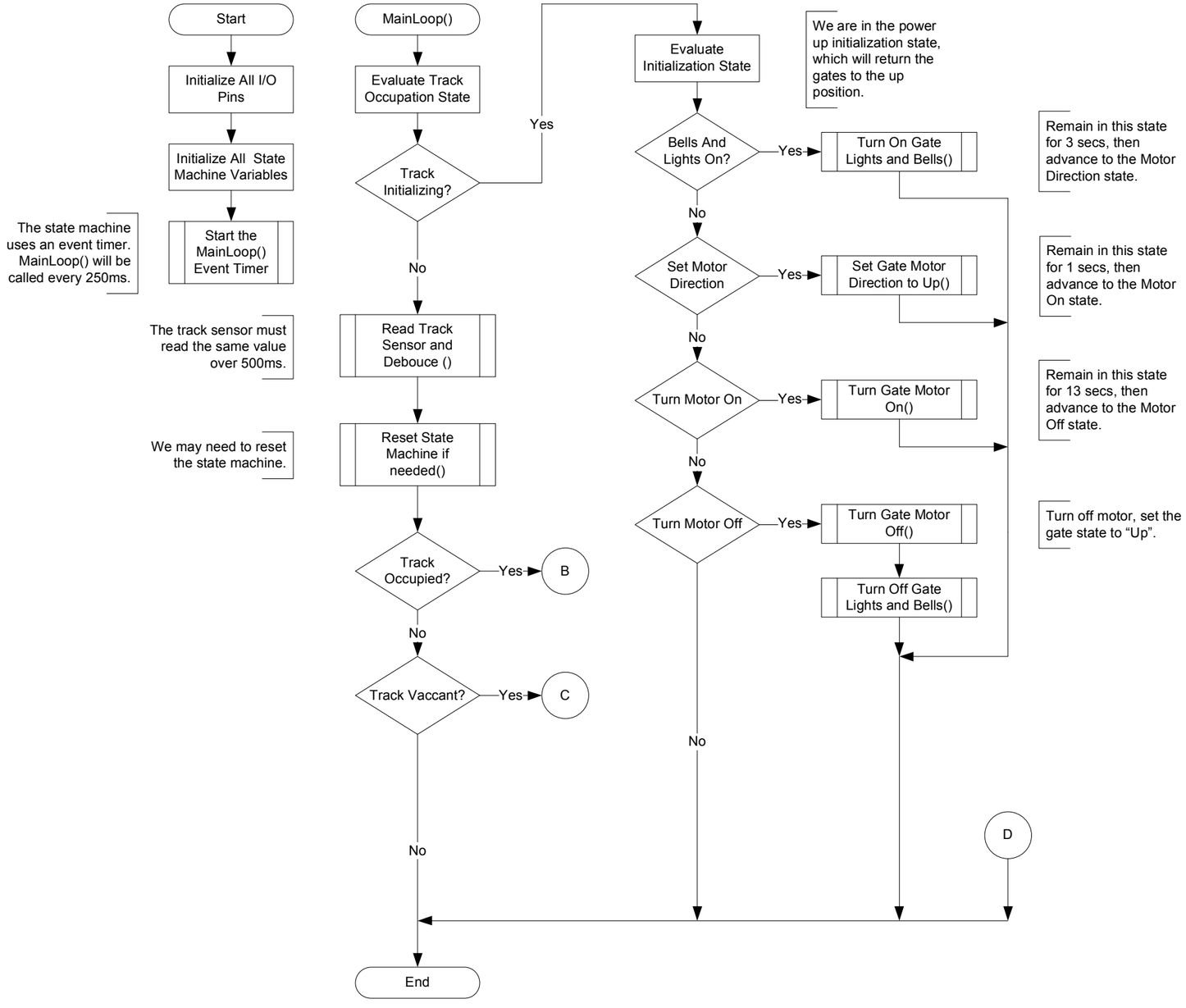
R3 1500 Ω ¼ W
Q3 TIP3055
Right Light
D7
D3 1N4001
Q7 2N2222
R7 210 Ω ¼ W
R16 560 Ω ¼ W

R4 1500 Ω ¼ W
Q3 TIP3055
Left Light
D8
D4 1N4001
Q8 2N2222
R8 210 Ω ¼ W
R17 560 Ω ¼ W

Park Train Crossing Guard Schematic		
Chuck Hardt	05/08/16	Rev: 1.04

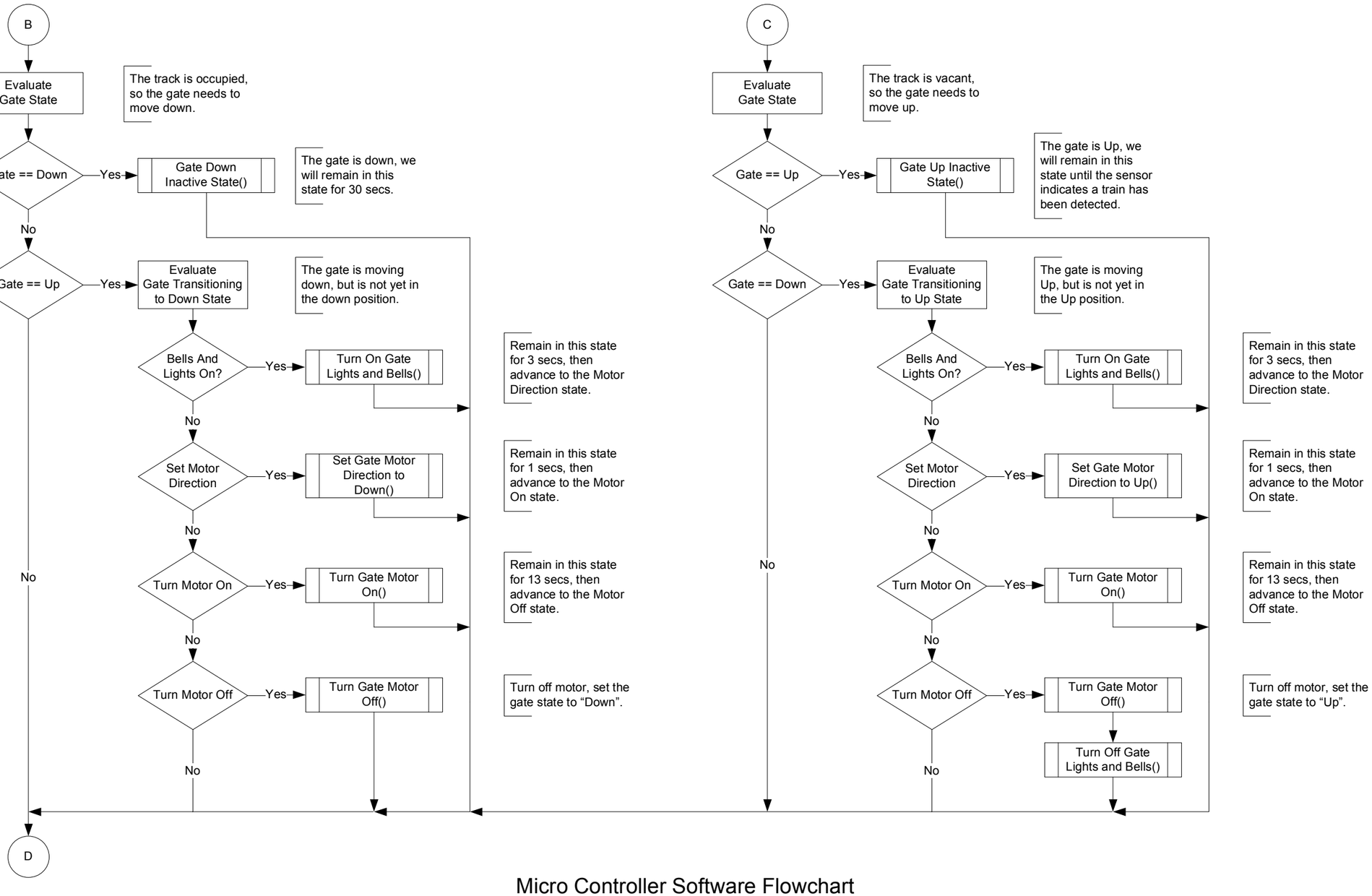


Park Train Crossing Guard Schematic		
Chuck Hardt	05/08/16	Rev: 1.04



Micro Controller Software Flowchart

Park Train Crossing Guard Schematic		
Chuck Hardt	05/08/16	Rev: 1.04



Micro Controller Software Flowchart

Park Train Crossing Guard Schematic		
Chuck Hardt	05/08/16	Rev: 1.04