TPMS

SS

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Odyssey

From http://opengarages.org/handbook/ebook/, TPMS data can be exploted in the following ways:

- Send an impossible condition to the engine control unit (ECU), causing a fault that could then be exploited
- Trick the ECU into overcorrecting for spoofed road conditions
- Put the TPMS receiver or the ECU into an unrecoverable state that might cause a driver to pull over to check for a reported flat or that might even shut down the vehicle
- Track a vehicle based on the TPMS unique IDs
- Spoof the TPMS signal to set off internal alarms

This project uses the code at https://github.com/jboone/gr-tpms to capture bursts at 315 MHz, using a 400 kHz sampling rate. The author's talk, using an earlier version of the code, can be found here: http://www.youtube.com/watch?v=bKqiq2Y43Wg.

Previous research on the topic can be found at:

- https://web.wpi.edu/Pubs/E-project/Available/E-project-091115-154458/unrestricted/MQP_piscitelli_arnold_2015.pdf
- https://web.wpi.edu/Pubs/E-project/Available/E-project-030416-121729/unrestricted/MQP_Final_Paper.pdf
- http://www.winlab.rutgers.edu/~gruteser/papers/xu_tpms10.pdf

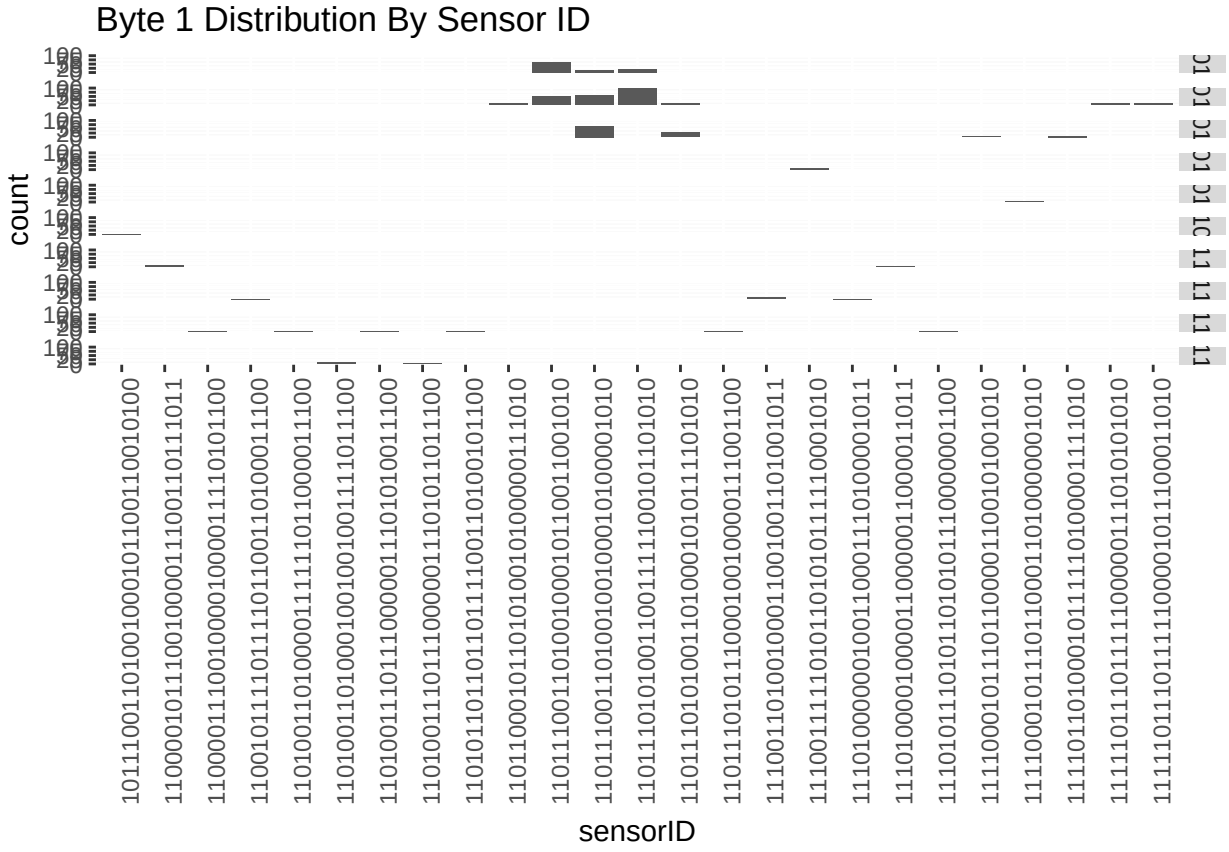
Distribution of sensor IDs

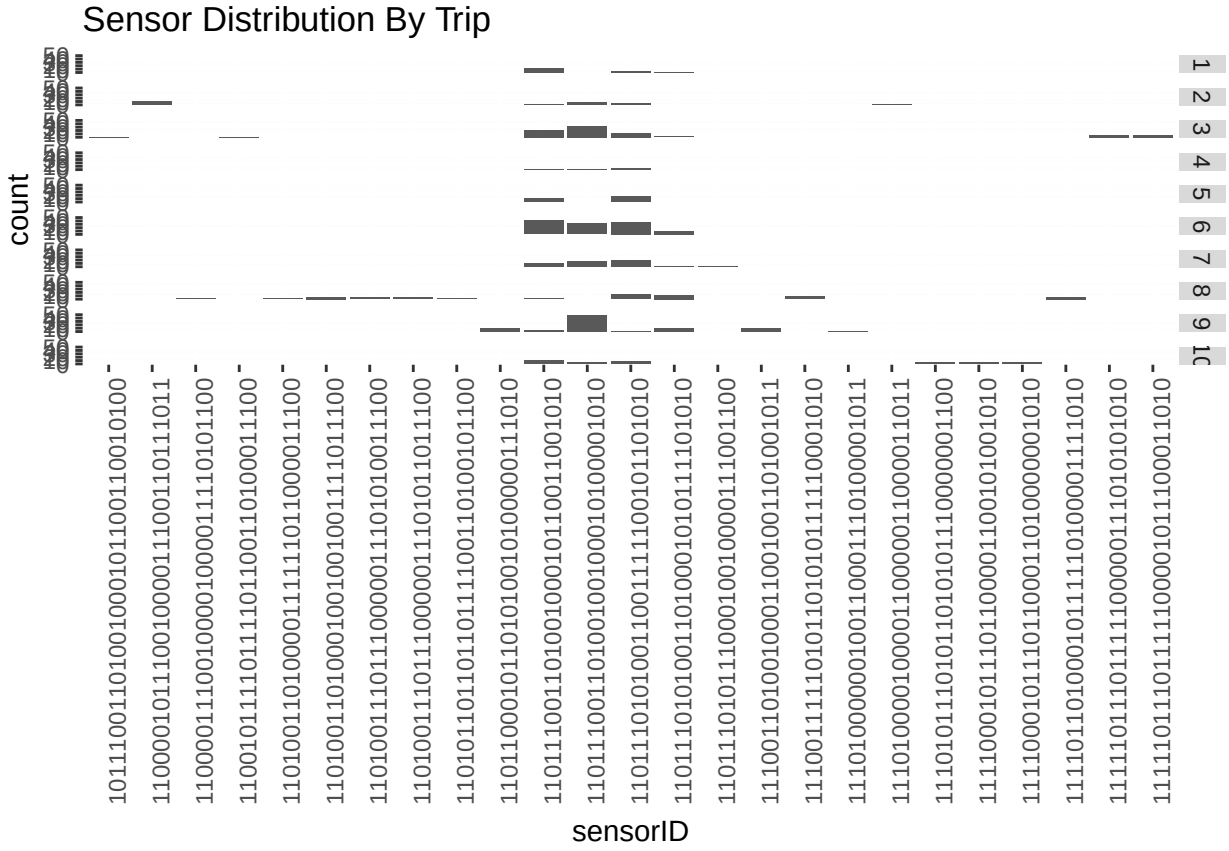
```
##
## 10111001101001000101100110010100 11000010111001000011100110111011
##                                1                                9
## 11000011100100001000011110101100 11001011110111101100110100011100
##                                2                                1
## 11010011010000111111011000011100 11010011010001001001001111011100
##                                1                                6
## 11010011101110000011101010011100 11010011101110000011101011011100
##                                5                                4
## 11010110110110111100110100101100 11011000101101010010100000111010
##                                1                                9
## 11011100110100100010110011001010 11011100110100100100010100001010
##                              113                              140
## 11011101010011001111100101101010 11011101010011010001010111101010
##                              116                               37
## 11011101011100010010000111001100 11100110100100011001001101001011
##                                2                               10
## 11100111110101101010111110001010 11101000000100110001110100001011
##                                8                                2
## 11101000010000110000011000011011 11101011101011010101110000001100
##                                2                                3
## 11110001011101100001100101001010 11110001011101100011010000001010
```

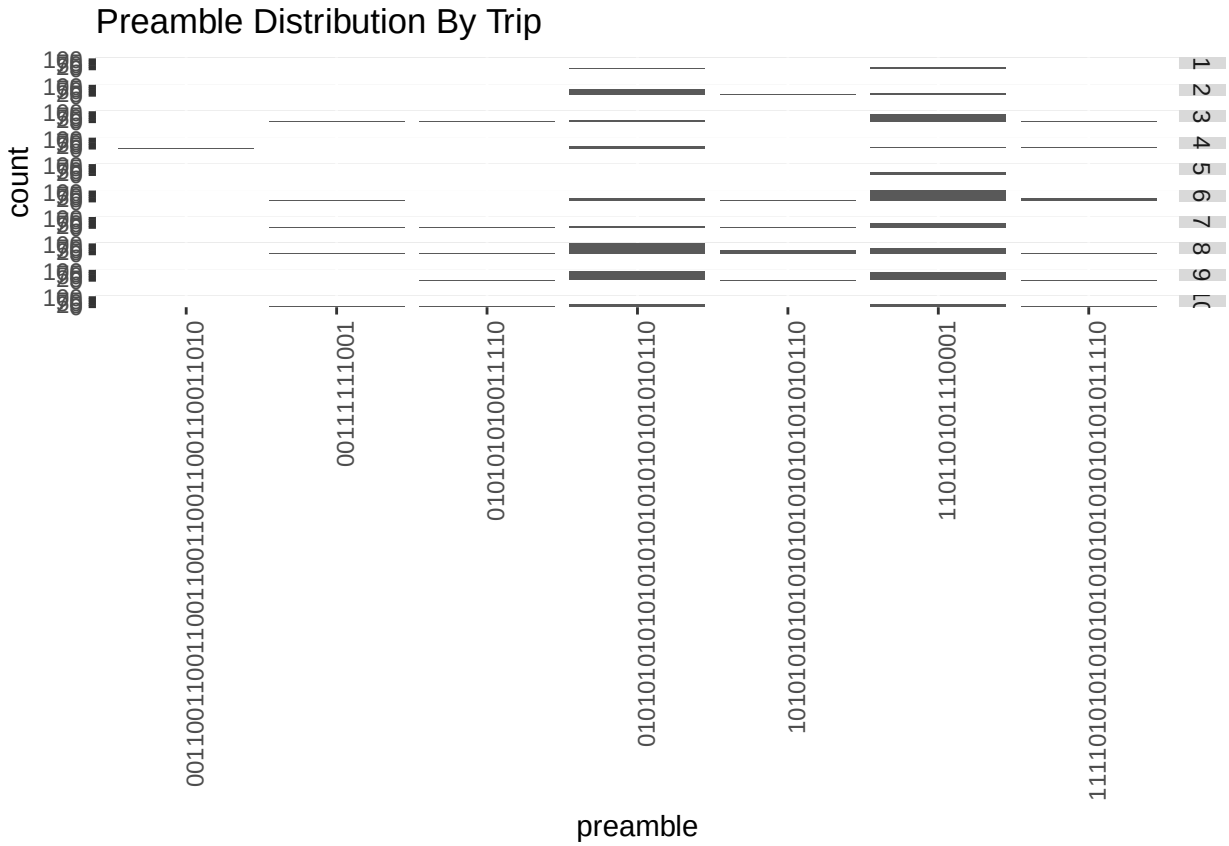
```
##                                  4                                   4
## 11110110100010111110100001111010 11111011101111100000111010101010
##                                  6                                   6
## 11111011101111100001011100011010
##                                  6
```

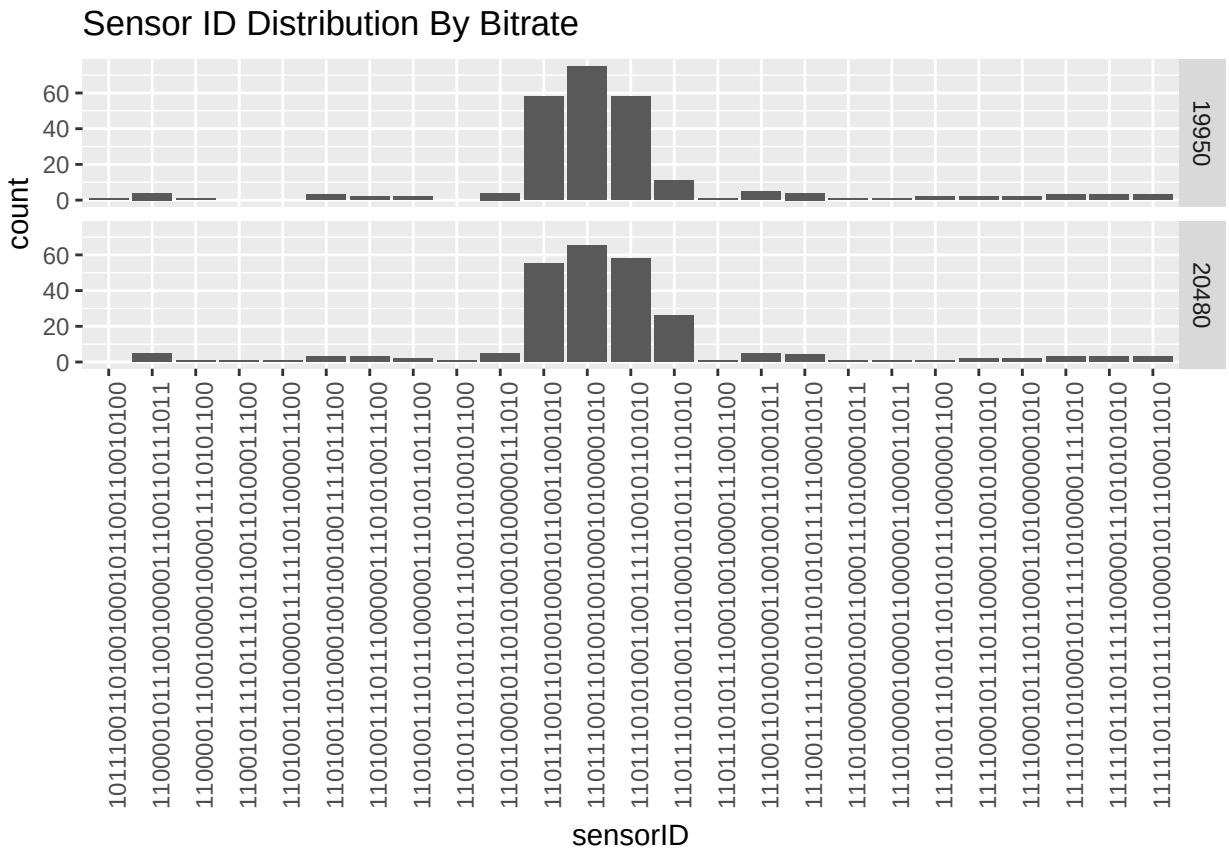
First 3 bytes, statistical distribution

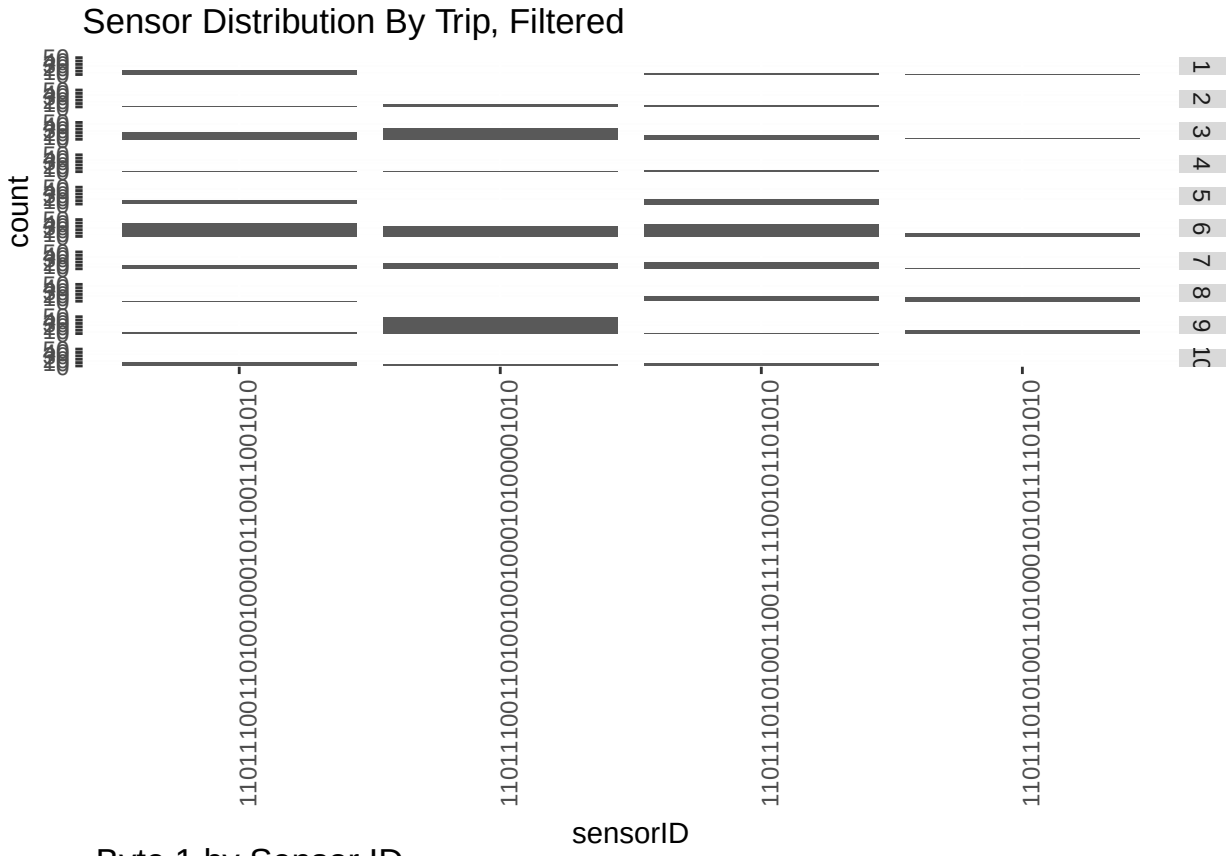
```
## Byte 1:
## byte
## 00001001 00001010 00001011 00001100 00001101 01010011 11111001 11111010
##      100      232      105        8        4        1       11       13
## 11111011 11111100
##       14       10
## Byte 2:
## byte
## 00000011 00000100 00010011 00010100 00100010 00100011 00100100 00110011
##        8       21       16        9        2       16       15       23
## 00110100 01000010 01000011 01000100 01010010 01010011 01010100 01100011
##        7        5        6        9        4       31       18       20
## 01100100 01100101 01110010 01110011 01110100 10000010 10000011 10000100
##       17        1        4       16        2        5       14        5
## 10010011 10010100 10100010 10100011 10100100 10110010 10110011 10110100
##       27       16        2       26        1        4       11        4
## 11000010 11000011 11000100 11010011 11100010 11100011 11100100 11110010
##        4       28        1       19        1       43       15       10
## 11110011 11110100
##       10        2
## Byte 3:
## byte
## 00001000 00001010 00001100 00011000 00011010 00011100 00011101 00101000
##       42        2        2       34        2        1        9       26
## 00101101 00111000 01001000 01011000 01011101 01101000 01111000 01111101
##        2       23       17       42        6       26       12        8
## 10001000 10001100 10011000 10011100 10101000 10101100 10101101 10110001
##       14        4        9        4       42        3        6        1
## 10111000 11001000 11001010 11011000 11101000 11101100 11111000
##       49       38       19       25        7        6       17
```

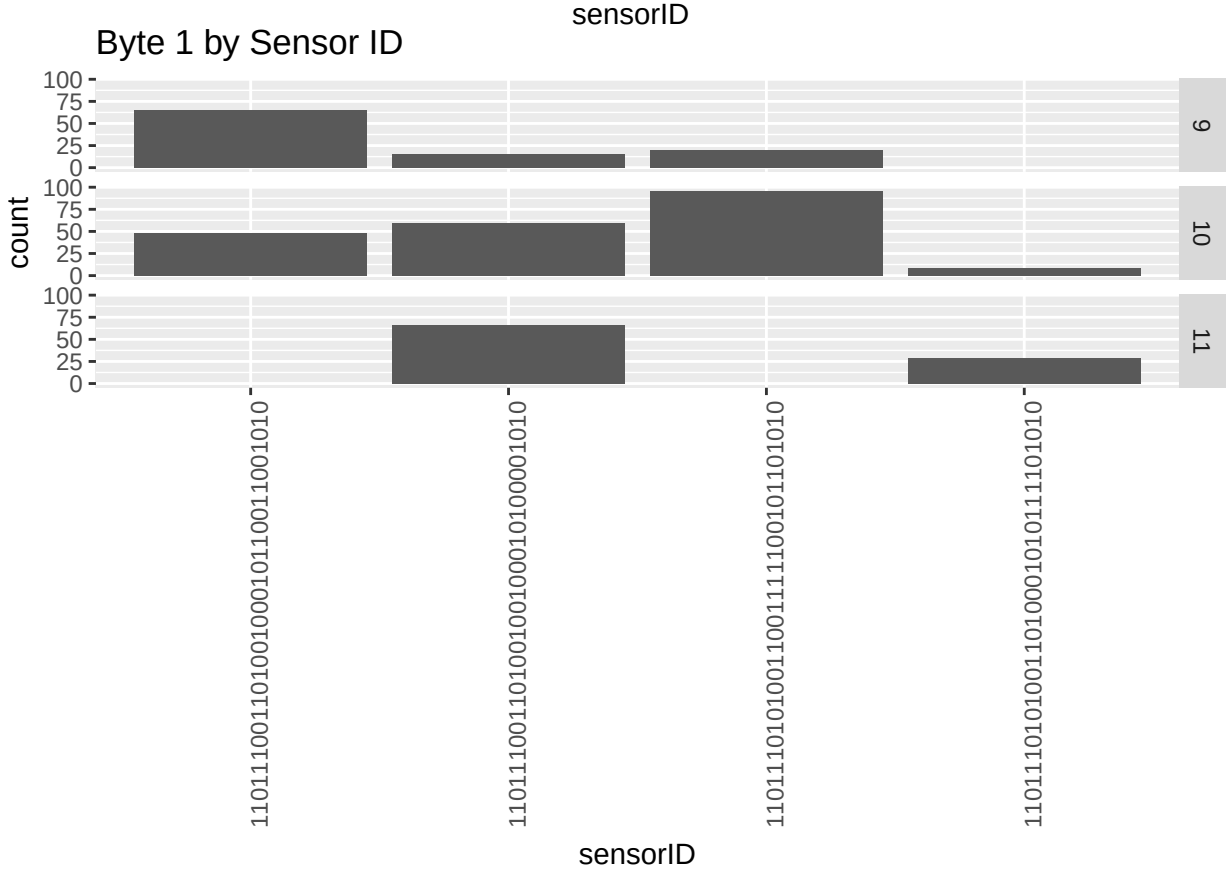

Byte 1 Distribution By Sensor ID
count
sensorID

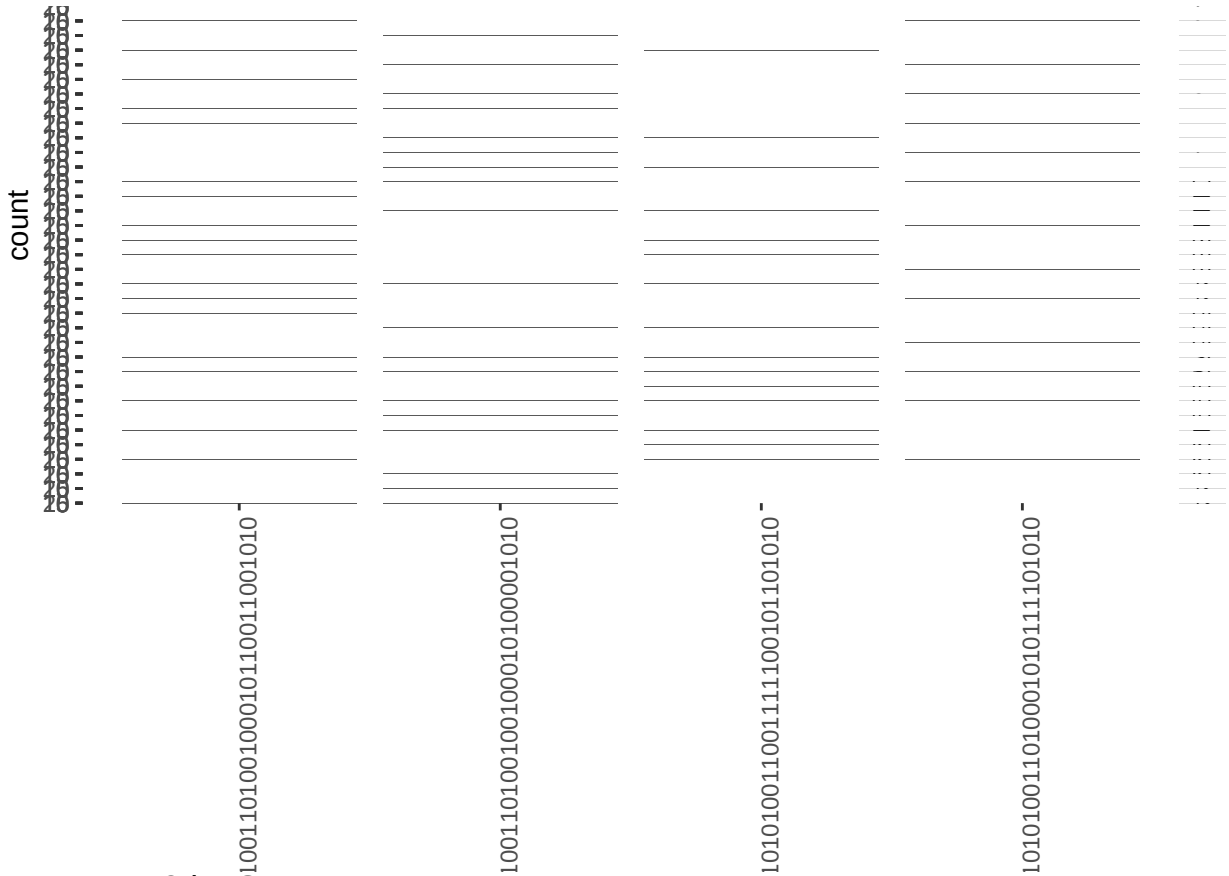

Sensor Distribution By Trip
count
sensorID


Preamble Distribution By Trip
count
preamble
0011001100110011001100110011001100110010
00111111001
01010101001111 0
0101010101010101010101010101010
1010101010101010101010101010110
1101101011100 01
1111010101010101010101010101110

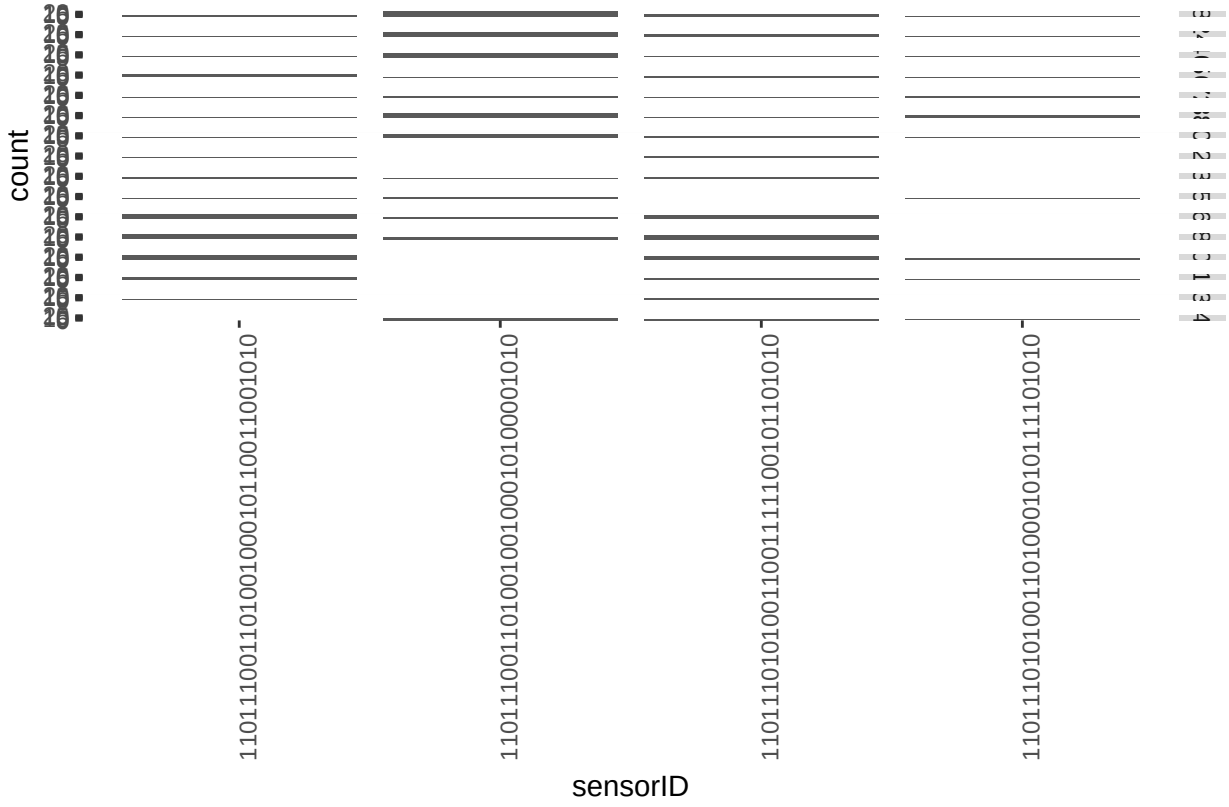

Sensor ID Distribution By Bitrate
count
sensorID
19950
20480

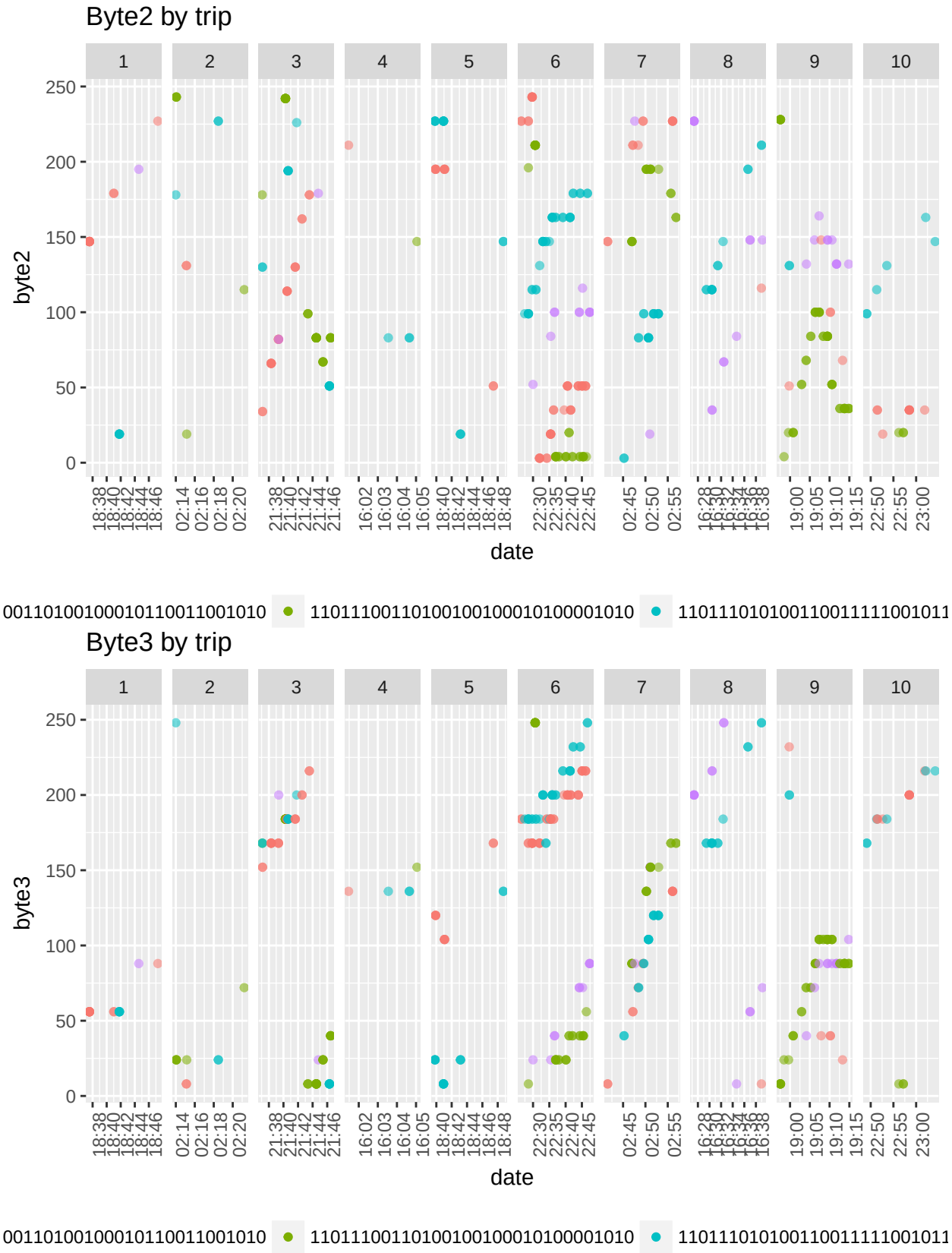

Sensor Distribution By Trip, Filtered
count
1 2 3 4 5 6 7 8 9 10
1101110011010010001011001100110001010
1101110011010010001000101000010100001010
1101110101001100111110010101101010
1101110101001101000101011110101010
sensorID


Byte 1 by Sensor ID
count
100
75
50
25
0
9
10
11
1101110011010010001011001100110001010
1101110011010010001000101000010100001010
1101110101001100111110010101101010
1101110101001101000101011110101010
sensorID



Byte 3 by Sensor ID




Byte2 by trip
1
2
3
4
5
6
7
8
9
10
byte2
250
200
150
100
50
0
18:38
18:40
18:42
18:44
18:46
02:14
02:16
02:18
02:20
21:38
21:40
21:42
21:44
21:46
16:02
16:03
16:04
16:05
18:40
18:42
18:44
18:46
18:48
22:30
22:35
22:40
22:45
02:45
02:50
02:55
16:28
16:30
16:34
16:36
16:38
19:00
19:05
19:10
19:15
22:50
22:55
23:00
date
00110100100010110011001010
11011100110100100100010100001010
11011101010011001111100101 1
Byte3 by trip
1
2
3
4
5
6
7
8
9
10
byte3
250
200
150
100
50
0
18:38
18:40
18:42
18:44
18:46
02:14
02:16
02:18
02:20
21:38
21:40
21:42
21:44
21:46
16:02
16:03
16:04
16:05
18:40
18:42
18:44
18:46
18:48
22:30
22:35
22:40
22:45
02:45
02:50
02:55
16:28
16:30
16:34
16:36
16:38
19:00
19:05
19:10
19:15
22:50
22:55
23:00
date
00110100100010110011001010
11011100110100100100010100001010
11011101010011001111100101 1