```vhdl
 1    ----------------------------------------------------------------------------
 2    -- Company:
 3    -- Engineer:
 4    --
 5    -- Create Date:    13:56:46 11/29/2018
 6    -- Design Name:
 7    -- Module Name:    BikeLockDebug - Behavioral
 8    -- Project Name:
 9    -- Target Devices:
10    -- Tool versions:
11    -- Description:
12    --
13    -- Dependencies:
14    --
15    -- Revision:
16    -- Revision 0.01 - File Created
17    -- Additional Comments:
18    --
19    ----------------------------------------------------------------------------
20    library IEEE;
21    use IEEE.STD_LOGIC_1164.ALL;
22
23    -- Uncomment the following library declaration if using
24    -- arithmetic functions with Signed or Unsigned values
25    --use IEEE.NUMERIC_STD.ALL;
26
27    -- Uncomment the following library declaration if instantiating
28    -- any Xilinx primitives in this code.
29    --library UNISIM;
30    --use UNISIM.VComponents.all;
31
32    entity BikeLockDebug is
33        Port( clk,H,reset : in STD_LOGIC; -- Both H and reset are active high
34                X : in STD_LOGIC_VECTOR (4 DOWNTO 0);
35                LED : out STD_LOGIC_VECTOR(7 downto 0);
36                debug : in std_logic
37                );
38    end BikeLockDebug;
39
40    architecture Behavioral of BikeLockDebug is
41        Type state_type is (s0,s1,s2,s3,s4,s5,s6,s7,s8,s9,s10,s11,s12,s13,s14,s15,s16,s17,
      s18,s19,
42                            s20,s21,s22,s23,s24,s25,s26,s27,s28,s29,s30,s31,s32,s33,s34,
      s35,s36,s37,s38,s39,
43                            s40,s41,s42,s43,s44,s45,s46,s47,s48,s49,s50,s51,s52,s53,s54,
      s55,s56,s57,s58,s59);
44
45        Signal p_state,n_state : state_type;
46        signal L,A,R_state,L_state,A_state : STD_LOGIC;
47
48
49    begin
50        Process(debug)
51        begin
52        if debug = '1' then
53            LED <= x"00";
54            case p_state is
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 55            when s1 | s3 | s5 | s7 | s9 | s11 | s13 | s15 | s17 | s19 |
 56                 s21 | s23 | s25 | s27 | s29 | s31 | s33 | s35 | s37 | s39 |
 57                 s41 | s43 | s45 | s47 | s49 | s51 | s53 | s55 | s57 | s59 => LED(0) <=
     '1';
 58            when others =>
 59          end case;
 60          case p_state is
 61            when s2 | s3 | s6 | s7 | s10 | s11 | s14 | s15 | s18 | s19 |
 62                 s22 | s23 | s26 | s27 | s30 | s31 | s34 | s35 | s38 | s39 |
 63                 s42 | s43 | s46 | s47 | s50 | s51 | s54 | s55 | s58 | s59 => LED(1) <=
     '1';
 64            when others =>
 65          end case;
 66          case p_state is
 67            when s4 | s5 | s6 | s7 | s12 | s13 | s14 | s15 | s20 | s21 |
 68                 s22 | s23 | s28 | s29 | s30 | s31 | s36 | s37 | s38 | s39 |
 69                 s44 | s45 | s46 | s47 | s52 | s53 | s54 | s55 | s59 => LED(2) <= '1';
 70            when others =>
 71          end case;
 72          case p_state is
 73            when s8 | s9 | s10 | s11 | s12 | s13 | s14 | s15 | s24 | s25 |
 74                 s26 | s27 | s28 | s29 | s30 | s31 | s40 | s41 | s42 | s43 |
 75                 s44 | s45 | s46 | s47 | s56 | s57 | s58 | s59 => LED(3) <= '1';
 76            when others =>
 77          end case;
 78          case p_state is
 79            when s16 | s17 | s18 | s19 | s20 | s21 | s22 | s23 | s24 | s25 |
 80                 s26 | s27 | s28 | s29 | s30 | s31 | s48 | s49 | s50 | s51 |
 81                 s52 | s53 | s54 | s55 | s56 | s57 | s58 | s59 => LED(4) <= '1';
 82            when others =>
 83          end case;
 84          case p_state is
 85            when s32 | s33 | s34 | s35 | s36 | s37 | s38 | s39 | s40 | s41 |
 86                 s42 | s43 | s44 | s45 | s46 | s47 | s48 | s49 | s50 | s51 |
 87                 s52 | s53 | s54 | s55 | s56 | s57 | s58 | s59 => LED(5) <= '1';
 88            when others =>
 89          end case;
 90        else
 91          LED(1) <= L;
 92          LED(0) <= A;
 93          LED(7) <= R_state;
 94          LED(6) <= L_state;
 95          LED(5) <= A_state;
 96          LED(2) <= '0';
 97          LED(3) <= '0';
 98          LED(4) <= '0';
 99        end if;
100        end process;
101
102        Process(clk,reset)
103          begin
104          if(reset = '1' ) then
105            p_state <= s0;
106          elsif(clk' event and clk ='1') then
107            p_state <= n_state;
108          end if;
109        end process;
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110
111         Process(X,H,p_state)
112         begin
113             case h is
114                 when '1' =>
115                     case p_state is
116
117         --This is where the Unarmed or Unlocked state begins
118                         when s0 =>
119                             case X is
120                                 when "00000" => n_state <= s0; L<='0'; A<='0';
121                                 when "00001" => n_state <= s0; L<='0'; A<='0';
122                                 when "00010" => n_state <= s0; L<='0'; A<='0';
123                                 when "00100" => n_state <= s1; L<='0'; A<='0';
124                                 when "01000" => n_state <= s0; L<='0'; A<='0';
125                                 when "10000" => n_state <= s0; L<='0'; A<='0';
126                                 when others =>
127                             end case;
128                         when s1 =>
129                             case X is
130                                 when "00000" => n_state <= s2; L<='0'; A<='0';
131                                 when "00100" => n_state <= s1; L<='0'; A<='0';
132                                 when others =>
133                             end case;
134                         when s2 =>
135                             case X is
136                                 when "00000" => n_state <= s2; L<='0'; A<='0';
137                                 when "00001" => n_state <= s3; L<='0'; A<='0';
138                                 when "00010" => n_state <= s59; L<='0'; A<='0';
139                                 when "00100" => n_state <= s59; L<='0'; A<='0';
140                                 when "01000" => n_state <= s59; L<='0'; A<='0';
141                                 when "10000" => n_state <= s59; L<='0'; A<='0';
142                                 when others =>
143                             end case;
144                         when s3 =>
145                             case X is
146                                 when "00000" => n_state <= s4; L<='0'; A<='0';
147                                 when "00001" => n_state <= s3; L<='0'; A<='0';
148                                 when others =>
149                             end case;
150                         when s4 =>
151                             case X is
152                                 when "00000" => n_state <= s4; L<='0'; A<='0';
153                                 when "00001" => n_state <= s59; L<='0'; A<='0';
154                                 when "00010" => n_state <= s59; L<='0'; A<='0';
155                                 when "00100" => n_state <= s59; L<='0'; A<='0';
156                                 when "01000" => n_state <= s5; L<='0'; A<='0';
157                                 when "10000" => n_state <= s59; L<='0'; A<='0';
158                                 when others =>
159                             end case;
160                         when s5 =>
161                             case X is
162                                 when "00000" => n_state <= s6; L<='0'; A<='0';
163                                 when "01000" => n_state <= s5; L<='0'; A<='0';
164                                 when others =>
165                             end case;
166                         when s6 =>
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167                        case X is
168                            when "00000" => n_state <= s6; L<='0'; A<='0';
169                            when "00001" => n_state <= s59; L<='0'; A<='0';
170                            when "00010" => n_state <= s59; L<='0'; A<='0';
171                            when "00100" => n_state <= s59; L<='0'; A<='0';
172                            when "01000" => n_state <= s7; L<='0'; A<='0';
173                            when "10000" => n_state <= s59; L<='0'; A<='0';
174                            when others =>
175                        end case;
176                    when s7 =>
177                        case X is
178                            when "00000" => n_state <= s8; L<='0'; A<='0';
179                            when "01000" => n_state <= s7; L<='0'; A<='0';
180                            when others =>
181                        end case;
182                    when s8 =>
183                        case X is
184                            when "00000" => n_state <= s8; L<='0'; A<='0';
185                            when "00001" => n_state <= s59; L<='0'; A<='0';
186                            when "00010" => n_state <= s9; L<='0'; A<='0';
187                            when "00100" => n_state <= s59; L<='0'; A<='0';
188                            when "01000" => n_state <= s59; L<='0'; A<='0';
189                            when "10000" => n_state <= s59; L<='0'; A<='0';
190                            when others =>
191                        end case;
192                    when s9 =>
193                        case X is
194                            when "00000" => n_state <= s10; L<='0'; A<='0';
195                            when "00010" => n_state <= s9; L<='0'; A<='0';
196                            when others =>
197                        end case;
198                    when s10 =>
199                        case X is
200                            when "00000" => n_state <= s10; L<='0'; A<='0';
201                            when "00001" => n_state <= s59; L<='0'; A<='0';
202                            when "00010" => n_state <= s59; L<='0'; A<='0';
203                            when "00100" => n_state <= s59; L<='0'; A<='0';
204                            when "01000" => n_state <= s59; L<='0'; A<='0';
205                            when "10000" => n_state <= s11; L<='0'; A<='0';
206                            when others =>
207                        end case;
208                    when s11 =>
209                        case X is
210                            when "00000" => n_state <= s12; L<='0'; A<='0';
211                            when "10000" => n_state <= s11; L<='0'; A<='0';
212                            when others =>
213                        end case;
214
215    --This is where the Armed or Locked state begins
216        --This is the 'correct input' path for the Armed or Locked State
217                    when s12 =>
218                        case X is
219                            when "00000" => n_state <= s12; L<='1'; A<='0';
220                            when "00001" => n_state <= s24; L<='1'; A<='0';
221                            when "00010" => n_state <= s24; L<='1'; A<='0';
222                            when "00100" => n_state <= s13; L<='1'; A<='0';
223                            when "01000" => n_state <= s24; L<='1'; A<='0';
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224                 when "10000" => n_state <= s12; L<='1'; A<='0';
225                 when others =>
226             end case;
227         when s13 =>
228             case X is
229                 when "00000" => n_state <= s14; L<='1'; A<='0';
230                 when "00100" => n_state <= s13; L<='1'; A<='0';
231                 when others =>
232             end case;
233         when s14 =>
234             case X is
235                 when "00000" => n_state <= s14; L<='1'; A<='0';
236                 when "00001" => n_state <= s15; L<='1'; A<='0';
237                 when "00010" => n_state <= s26; L<='1'; A<='0';
238                 when "00100" => n_state <= s37; L<='1'; A<='0';
239                 when "01000" => n_state <= s26; L<='1'; A<='0';
240                 when "10000" => n_state <= s36; L<='1'; A<='0';
241                 when others =>
242             end case;
243         when s15 =>
244             case X is
245                 when "00000" => n_state <= s16; L<='1'; A<='0';
246                 when "00001" => n_state <= s15; L<='1'; A<='0';
247                 when others =>
248             end case;
249         when s16 =>
250             case X is
251                 when "00000" => n_state <= s16; L<='1'; A<='0';
252                 when "00001" => n_state <= s28; L<='1'; A<='0';
253                 when "00010" => n_state <= s28; L<='1'; A<='0';
254                 when "00100" => n_state <= s39; L<='1'; A<='0';
255                 when "01000" => n_state <= s17; L<='1'; A<='0';
256                 when "10000" => n_state <= s36; L<='1'; A<='0';
257                 when others =>
258             end case;
259         when s17 =>
260             case X is
261                 when "00000" => n_state <= s18; L<='1'; A<='0';
262                 when "01000" => n_state <= s17; L<='1'; A<='0';
263                 when others =>
264             end case;
265         when s18 =>
266             case X is
267                 when "00000" => n_state <= s18; L<='1'; A<='0';
268                 when "00001" => n_state <= s30; L<='1'; A<='0';
269                 when "00010" => n_state <= s30; L<='1'; A<='0';
270                 when "00100" => n_state <= s41; L<='1'; A<='0';
271                 when "01000" => n_state <= s19; L<='1'; A<='0';
272                 when "10000" => n_state <= s36; L<='1'; A<='0';
273                 when others =>
274             end case;
275         when s19 =>
276             case X is
277                 when "00000" => n_state <= s20; L<='1'; A<='0';
278                 when "01000" => n_state <= s19; L<='1'; A<='0';
279                 when others =>
280             end case;
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281                    when s20 =>
282                       case X is
283                          when "00000" => n_state <= s20; L<='1'; A<='0';
284                          when "00001" => n_state <= s32; L<='1'; A<='0';
285                          when "00010" => n_state <= s21; L<='1'; A<='0';
286                          when "00100" => n_state <= s43; L<='1'; A<='0';
287                          when "01000" => n_state <= s32; L<='1'; A<='0';
288                          when "10000" => n_state <= s36; L<='1'; A<='0';
289                          when others =>
290                       end case;
291                    when s21 =>
292                       case X is
293                          when "00000" => n_state <= s22; L<='1'; A<='0';
294                          when "00010" => n_state <= s21; L<='1'; A<='0';
295                          when others =>
296                       end case;
297                    when s22 =>
298                       case X is
299                          when "00000" => n_state <= s22; L<='1'; A<='0';
300                          when "00001" => n_state <= s34; L<='1'; A<='0';
301                          when "00010" => n_state <= s34; L<='1'; A<='0';
302                          when "00100" => n_state <= s45; L<='1'; A<='0';
303                          when "01000" => n_state <= s34; L<='1'; A<='0';
304                          when "10000" => n_state <= s23; L<='1'; A<='0';
305                          when others =>
306                       end case;
307                    when s23 =>
308                       case X is
309                          when "00000" => n_state <= s0; L<='0'; A<='0';
310                          when "10000" => n_state <= s23; L<='1'; A<='0';
311                          when others =>
312                       end case;
313
314            --These is the 'failed input' path for the Armed state
315                    when s24 =>
316                       case X is
317                          when "00000" => n_state <= s25; L<='1'; A<='0';
318                          when "00001" => n_state <= s24; L<='1'; A<='0';
319                          when "00010" => n_state <= s24; L<='1'; A<='0';
320                          when "00100" => n_state <= s24; L<='1'; A<='0';
321                          when "01000" => n_state <= s24; L<='1'; A<='0';
322                          when "10000" => n_state <= s24; L<='1'; A<='0';
323                          when others =>
324                       end case;
325                    when s25 =>
326                       case X is
327                          when "00000" => n_state <= s25; L<='1'; A<='0';
328                          when "00001" => n_state <= s26; L<='1'; A<='0';
329                          when "00010" => n_state <= s26; L<='1'; A<='0';
330                          when "00100" => n_state <= s37; L<='1'; A<='0';
331                          when "01000" => n_state <= s26; L<='1'; A<='0';
332                          when "10000" => n_state <= s36; L<='1'; A<='0';
333                          when others =>
334                       end case;
335                    when s26 =>
336                       case X is
337                          when "00000" => n_state <= s27; L<='1'; A<='0';
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338                     when "00001" => n_state <= s26; L<='1'; A<='0';
339                     when "00010" => n_state <= s26; L<='1'; A<='0';
340                     when "01000" => n_state <= s26; L<='1'; A<='0';
341                     when others =>
342                  end case;
343               when s27 =>
344                  case X is
345                     when "00000" => n_state <= s27; L<='1'; A<='0';
346                     when "00001" => n_state <= s28; L<='1'; A<='0';
347                     when "00010" => n_state <= s28; L<='1'; A<='0';
348                     when "00100" => n_state <= s39; L<='1'; A<='0';
349                     when "01000" => n_state <= s28; L<='1'; A<='0';
350                     when "10000" => n_state <= s36; L<='1'; A<='0';
351                     when others =>
352                  end case;
353               when s28 =>
354                  case X is
355                     when "00000" => n_state <= s29; L<='1'; A<='0';
356                     when "00001" => n_state <= s28; L<='1'; A<='0';
357                     when "00010" => n_state <= s28; L<='1'; A<='0';
358                     when "01000" => n_state <= s28; L<='1'; A<='0';
359                     when others =>
360                  end case;
361               when s29 =>
362                  case X is
363                     when "00000" => n_state <= s29; L<='1'; A<='0';
364                     when "00001" => n_state <= s30; L<='1'; A<='0';
365                     when "00010" => n_state <= s30; L<='1'; A<='0';
366                     when "00100" => n_state <= s41; L<='1'; A<='0';
367                     when "01000" => n_state <= s30; L<='1'; A<='0';
368                     when "10000" => n_state <= s36; L<='1'; A<='0';
369                     when others =>
370                  end case;
371               when s30 =>
372                  case X is
373                     when "00000" => n_state <= s31; L<='1'; A<='0';
374                     when "00001" => n_state <= s30; L<='1'; A<='0';
375                     when "00010" => n_state <= s30; L<='1'; A<='0';
376                     when "01000" => n_state <= s30; L<='1'; A<='0';
377                     when others =>
378                  end case;
379               when s31 =>
380                  case X is
381                     when "00000" => n_state <= s31; L<='1'; A<='0';
382                     when "00001" => n_state <= s32; L<='1'; A<='0';
383                     when "00010" => n_state <= s32; L<='1'; A<='0';
384                     when "00100" => n_state <= s43; L<='1'; A<='0';
385                     when "01000" => n_state <= s32; L<='1'; A<='0';
386                     when "10000" => n_state <= s36; L<='1'; A<='0';
387                     when others =>
388                  end case;
389               when s32 =>
390                  case X is
391                     when "00000" => n_state <= s33; L<='1'; A<='0';
392                     when "00001" => n_state <= s32; L<='1'; A<='0';
393                     when "00010" => n_state <= s32; L<='1'; A<='0';
394                     when "01000" => n_state <= s32; L<='1'; A<='0';
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395                         when others =>
396                     end case;
397                 when s33 =>
398                     case X is
399                         when "00000" => n_state <= s33; L<='1'; A<='0';
400                         when "00001" => n_state <= s34; L<='1'; A<='0';
401                         when "00010" => n_state <= s34; L<='1'; A<='0';
402                         when "00100" => n_state <= s45; L<='1'; A<='0';
403                         when "01000" => n_state <= s34; L<='1'; A<='0';
404                         when "10000" => n_state <= s34; L<='1'; A<='0';
405                         when others =>
406                     end case;
407                 when s34 =>
408                     case X is
409                         when "00000" => n_state <= s35; L<='1'; A<='1';
410                         when "00001" => n_state <= s34; L<='1'; A<='0';
411                         when "00010" => n_state <= s34; L<='1'; A<='0';
412                         when "01000" => n_state <= s34; L<='1'; A<='0';
413                         when "10000" => n_state <= s34; L<='1'; A<='0';
414                         when others =>
415                     end case;
416
417         --This state is the beginning of the Alarm states
418                 when s35 =>
419                     case X is
420                         when "00000" => n_state <= s35; L<='1'; A<='1';
421                         when "00001" => n_state <= s35; L<='1'; A<='1';
422                         when "00010" => n_state <= s35; L<='1'; A<='1';
423                         when "00100" => n_state <= s47; L<='1'; A<='1';
424                         when "01000" => n_state <= s35; L<='1'; A<='1';
425                         when "10000" => n_state <= s35; L<='1'; A<='1';
426                         when others =>
427                     end case;
428
429         --This is the Armed X4 reset state
430                 when s36 =>
431                     case X is
432                         when "00000" => n_state <= s12; L<='1'; A<='0';
433                         when "00100" => n_state <= s36; L<='1'; A<='0';
434                         when "10000" => n_state <= s36; L<='1'; A<='0';
435                         when others =>
436                     end case;
437
438         --These are the states for Armed X2 resets
439                 when s37 =>
440                     case X is
441                         when "00000" => n_state <= s38; L<='1'; A<='0';
442                         when "00100" => n_state <= s37; L<='1'; A<='0';
443                         when others =>
444                     end case;
445                 when s38 =>
446                     case X is
447                         when "00000" => n_state <= s38; L<='1'; A<='0';
448                         when "00001" => n_state <= s28; L<='1'; A<='0';
449                         when "00010" => n_state <= s28; L<='1'; A<='0';
450                         when "00100" => n_state <= s36; L<='1'; A<='0';
451                         when "01000" => n_state <= s28; L<='1'; A<='0';
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452                    when "10000" => n_state <= s36; L<='1'; A<='0';
453                    when others =>
454                end case;
455            when s39 =>
456                case X is
457                    when "00000" => n_state <= s40; L<='1'; A<='0';
458                    when "00100" => n_state <= s39; L<='1'; A<='0';
459                    when others =>
460                end case;
461            when s40 =>
462                case X is
463                    when "00000" => n_state <= s40; L<='1'; A<='0';
464                    when "00001" => n_state <= s30; L<='1'; A<='0';
465                    when "00010" => n_state <= s30; L<='1'; A<='0';
466                    when "00100" => n_state <= s36; L<='1'; A<='0';
467                    when "01000" => n_state <= s30; L<='1'; A<='0';
468                    when "10000" => n_state <= s36; L<='1'; A<='0';
469                    when others =>
470                end case;
471            when s41 =>
472                case X is
473                    when "00000" => n_state <= s42; L<='1'; A<='0';
474                    when "00100" => n_state <= s41; L<='1'; A<='0';
475                    when others =>
476                end case;
477            when s42 =>
478                case X is
479                    when "00000" => n_state <= s42; L<='1'; A<='0';
480                    when "00001" => n_state <= s32; L<='1'; A<='0';
481                    when "00010" => n_state <= s32; L<='1'; A<='0';
482                    when "00100" => n_state <= s36; L<='1'; A<='0';
483                    when "01000" => n_state <= s32; L<='1'; A<='0';
484                    when "10000" => n_state <= s36; L<='1'; A<='0';
485                    when others =>
486                end case;
487            when s43 =>
488                case X is
489                    when "00000" => n_state <= s44; L<='1'; A<='0';
490                    when "00100" => n_state <= s43; L<='1'; A<='0';
491                    when others =>
492                end case;
493            when s44 =>
494                case X is
495                    when "00000" => n_state <= s44; L<='1'; A<='0';
496                    when "00001" => n_state <= s34; L<='1'; A<='0';
497                    when "00010" => n_state <= s34; L<='1'; A<='0';
498                    when "00100" => n_state <= s36; L<='1'; A<='0';
499                    when "01000" => n_state <= s34; L<='1'; A<='0';
500                    when "10000" => n_state <= s34; L<='1'; A<='0';
501                    when others =>
502                end case;
503            when s45 =>
504                case X is
505                    when "00000" => n_state <= s46; L<='1'; A<='0';
506                    when "00100" => n_state <= s45; L<='1'; A<='0';
507                    when others =>
508                end case;
```

```
509                     when s46 =>
510                         case X is
511                             when "00000" => n_state <= s46; L<='1'; A<='0';
512                             when "00001" => n_state <= s34; L<='1'; A<='0';
513                             when "00010" => n_state <= s34; L<='1'; A<='0';
514                             when "00100" => n_state <= s36; L<='1'; A<='0';
515                             when "01000" => n_state <= s34; L<='1'; A<='0';
516                             when "10000" => n_state <= s34; L<='1'; A<='0';
517                             when others =>
518                         end case;
519
520             --These are the Alarm unlocking states
521                 when s47 =>
522                     case X is
523                         when "00000" => n_state <= s48; L<='1'; A<='1';
524                         when "00100" => n_state <= s47; L<='1'; A<='1';
525                         when others =>
526                     end case;
527                 when s48 =>
528                     case X is
529                         when "00000" => n_state <= s48; L<='1'; A<='1';
530                         when "00001" => n_state <= s49; L<='1'; A<='1';
531                         when "00010" => n_state <= s58; L<='1'; A<='1';
532                         when "00100" => n_state <= s58; L<='1'; A<='1';
533                         when "01000" => n_state <= s58; L<='1'; A<='1';
534                         when "10000" => n_state <= s58; L<='1'; A<='1';
535                         when others =>
536                     end case;
537                 when s49 =>
538                     case X is
539                         when "00000" => n_state <= s50; L<='1'; A<='1';
540                         when "00001" => n_state <= s49; L<='1'; A<='1';
541                         when others =>
542                     end case;
543                 when s50 =>
544                     case X is
545                         when "00000" => n_state <= s50; L<='1'; A<='1';
546                         when "00001" => n_state <= s58; L<='1'; A<='1';
547                         when "00010" => n_state <= s58; L<='1'; A<='1';
548                         when "00100" => n_state <= s58; L<='1'; A<='1';
549                         when "01000" => n_state <= s51; L<='1'; A<='1';
550                         when "10000" => n_state <= s58; L<='1'; A<='1';
551                         when others =>
552                     end case;
553                 when s51 =>
554                     case X is
555                         when "00000" => n_state <= s52; L<='1'; A<='1';
556                         when "01000" => n_state <= s51; L<='1'; A<='1';
557                         when others =>
558                     end case;
559                 when s52 =>
560                     case X is
561                         when "00000" => n_state <= s52; L<='1'; A<='1';
562                         when "00001" => n_state <= s58; L<='1'; A<='1';
563                         when "00010" => n_state <= s58; L<='1'; A<='1';
564                         when "00100" => n_state <= s58; L<='1'; A<='1';
565                         when "01000" => n_state <= s53; L<='1'; A<='1';
```

```
566                     when "10000" => n_state <= s58; L<='1'; A<='1';
567                     when others =>
568                 end case;
569             when s53 =>
570                 case X is
571                     when "00000" => n_state <= s54; L<='1'; A<='1';
572                     when "01000" => n_state <= s53; L<='1'; A<='1';
573                     when others =>
574                 end case;
575             when s54 =>
576                 case X is
577                     when "00000" => n_state <= s54; L<='1'; A<='1';
578                     when "00001" => n_state <= s58; L<='1'; A<='1';
579                     when "00010" => n_state <= s55; L<='1'; A<='1';
580                     when "00100" => n_state <= s58; L<='1'; A<='1';
581                     when "01000" => n_state <= s58; L<='1'; A<='1';
582                     when "10000" => n_state <= s58; L<='1'; A<='1';
583                     when others =>
584                 end case;
585             when s55 =>
586                 case X is
587                     when "00000" => n_state <= s56; L<='1'; A<='1';
588                     when "00010" => n_state <= s55; L<='1'; A<='1';
589                     when others =>
590                 end case;
591             when s56 =>
592                 case X is
593                     when "00000" => n_state <= s56; L<='1'; A<='1';
594                     when "00001" => n_state <= s58; L<='1'; A<='1';
595                     when "00010" => n_state <= s58; L<='1'; A<='1';
596                     when "00100" => n_state <= s58; L<='1'; A<='1';
597                     when "01000" => n_state <= s58; L<='1'; A<='1';
598                     when "10000" => n_state <= s57; L<='1'; A<='1';
599                     when others =>
600                 end case;
601             when s57 =>
602                 case X is
603                     when "00000" => n_state <= s0; L<='0'; A<='0';
604                     when "10000" => n_state <= s57; L<='1'; A<='1';
605                     when others =>
606                 end case;
607
608         --This is the Alarm reset state
609             when s58 =>
610                 case X is
611                     when "00000" => n_state <= s35; L<='1'; A<='1';
612                     when "00001" => n_state <= s58; L<='1'; A<='1';
613                     when "00010" => n_state <= s58; L<='1'; A<='1';
614                     when "00100" => n_state <= s58; L<='1'; A<='1';
615                     when "01000" => n_state <= s58; L<='1'; A<='1';
616                     when "10000" => n_state <= s58; L<='1'; A<='1';
617                     when others =>
618                 end case;
619
620         --This is the Unarmed reset state and will lead to s0
621             when s59 =>
622                 case X is
```

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623                    when "00000" => n_state <= s0; L<='0'; A<='0';
624                    when "00001" => n_state <= s59; L<='0'; A<='0';
625                    when "00010" => n_state <= s59; L<='0'; A<='0';
626                    when "00100" => n_state <= s59; L<='0'; A<='0';
627                    when "01000" => n_state <= s59; L<='0'; A<='0';
628                    when "10000" => n_state <= s59; L<='0'; A<='0';
629                    when others =>
630                  end case;
631                when others =>
632              end case; --End of H = '1'
633
634      --This is when the lock is not latched
635            when '0' =>
636              case p_state is
637
638          -- Unlatched Unarmed states
639                when s0 => n_state <= s0; L<='0'; A<='0';
640                when s1 => n_state <= s0; L<='0'; A<='0';
641                when s2 => n_state <= s0; L<='0'; A<='0';
642                when s3 => n_state <= s0; L<='0'; A<='0';
643                when s4 => n_state <= s0; L<='0'; A<='0';
644                when s5 => n_state <= s0; L<='0'; A<='0';
645                when s6 => n_state <= s0; L<='0'; A<='0';
646                when s7 => n_state <= s0; L<='0'; A<='0';
647                when s8 => n_state <= s0; L<='0'; A<='0';
648                when s9 => n_state <= s0; L<='0'; A<='0';
649                when s10 => n_state <= s0; L<='0'; A<='0';
650                when s11 => n_state <= s0; L<='0'; A<='0';
651
652        --These are the unlatched Armed states
653                when s12 => n_state <= s35; L<='1'; A<='1';
654                when s13 => n_state <= s35; L<='1'; A<='1';
655                when s14 => n_state <= s35; L<='1'; A<='1';
656                when s15 => n_state <= s35; L<='1'; A<='1';
657                when s16 => n_state <= s35; L<='1'; A<='1';
658                when s17 => n_state <= s35; L<='1'; A<='1';
659                when s18 => n_state <= s35; L<='1'; A<='1';
660                when s19 => n_state <= s35; L<='1'; A<='1';
661                when s20 => n_state <= s35; L<='1'; A<='1';
662                when s21 => n_state <= s35; L<='1'; A<='1';
663                when s22 => n_state <= s35; L<='1'; A<='1';
664                when s23 => n_state <= s35; L<='1'; A<='1';
665                when s24 => n_state <= s35; L<='1'; A<='1';
666                when s25 => n_state <= s35; L<='1'; A<='1';
667                when s26 => n_state <= s35; L<='1'; A<='1';
668                when s27 => n_state <= s35; L<='1'; A<='1';
669                when s28 => n_state <= s35; L<='1'; A<='1';
670                when s29 => n_state <= s35; L<='1'; A<='1';
671                when s30 => n_state <= s35; L<='1'; A<='1';
672                when s31 => n_state <= s35; L<='1'; A<='1';
673                when s32 => n_state <= s35; L<='1'; A<='1';
674                when s33 => n_state <= s35; L<='1'; A<='1';
675                when s34 => n_state <= s35; L<='1'; A<='1';
676
677          --S35 is the beginning of the Alarm state
678                when s35 =>
679                  case X is
```

```
680                   when "00000" => n_state <= s35; L<='1'; A<='1';
681                   when "00001" => n_state <= s35; L<='1'; A<='1';
682                   when "00010" => n_state <= s35; L<='1'; A<='1';
683                   when "00100" => n_state <= s47; L<='1'; A<='1';
684                   when "01000" => n_state <= s35; L<='1'; A<='1';
685                   when "10000" => n_state <= s35; L<='1'; A<='1';
686                   when others =>
687                 end case;
688
689         --Unlatched Armed states continued
690             when s36 => n_state <= s35; L<='1'; A<='1';
691             when s37 => n_state <= s35; L<='1'; A<='1';
692             when s38 => n_state <= s35; L<='1'; A<='1';
693             when s39 => n_state <= s35; L<='1'; A<='1';
694             when s40 => n_state <= s35; L<='1'; A<='1';
695             when s41 => n_state <= s35; L<='1'; A<='1';
696             when s42 => n_state <= s35; L<='1'; A<='1';
697             when s43 => n_state <= s35; L<='1'; A<='1';
698             when s44 => n_state <= s35; L<='1'; A<='1';
699             when s45 => n_state <= s35; L<='1'; A<='1';
700             when s46 => n_state <= s35; L<='1'; A<='1';
701
702         --Unlatched Alarm States
703             when s47 =>
704               case X is
705                   when "00000" => n_state <= s48; L<='1'; A<='1';
706                   when "00100" => n_state <= s47; L<='1'; A<='1';
707                   when others =>
708                 end case;
709             when s48 =>
710               case X is
711                   when "00000" => n_state <= s48; L<='1'; A<='1';
712                   when "00001" => n_state <= s49; L<='1'; A<='1';
713                   when "00010" => n_state <= s58; L<='1'; A<='1';
714                   when "00100" => n_state <= s58; L<='1'; A<='1';
715                   when "01000" => n_state <= s58; L<='1'; A<='1';
716                   when "10000" => n_state <= s58; L<='1'; A<='1';
717                   when others =>
718                 end case;
719             when s49 =>
720               case X is
721                   when "00000" => n_state <= s50; L<='1'; A<='1';
722                   when "00001" => n_state <= s49; L<='1'; A<='1';
723                   when others =>
724                 end case;
725             when s50 =>
726               case X is
727                   when "00000" => n_state <= s50; L<='1'; A<='1';
728                   when "00001" => n_state <= s58; L<='1'; A<='1';
729                   when "00010" => n_state <= s58; L<='1'; A<='1';
730                   when "00100" => n_state <= s58; L<='1'; A<='1';
731                   when "01000" => n_state <= s51; L<='1'; A<='1';
732                   when "10000" => n_state <= s58; L<='1'; A<='1';
733                   when others =>
734                 end case;
735             when s51 =>
736               case X is
```

```
737                         when "00000" => n_state <= s52; L<='1'; A<='1';
738                         when "01000" => n_state <= s51; L<='1'; A<='1';
739                         when others =>
740                     end case;
741                 when s52 =>
742                     case X is
743                         when "00000" => n_state <= s52; L<='1'; A<='1';
744                         when "00001" => n_state <= s58; L<='1'; A<='1';
745                         when "00010" => n_state <= s58; L<='1'; A<='1';
746                         when "00100" => n_state <= s58; L<='1'; A<='1';
747                         when "01000" => n_state <= s53; L<='1'; A<='1';
748                         when "10000" => n_state <= s58; L<='1'; A<='1';
749                         when others =>
750                     end case;
751                 when s53 =>
752                     case X is
753                         when "00000" => n_state <= s54; L<='1'; A<='1';
754                         when "01000" => n_state <= s53; L<='1'; A<='1';
755                         when others =>
756                     end case;
757                 when s54 =>
758                     case X is
759                         when "00000" => n_state <= s54; L<='1'; A<='1';
760                         when "00001" => n_state <= s58; L<='1'; A<='1';
761                         when "00010" => n_state <= s55; L<='1'; A<='1';
762                         when "00100" => n_state <= s58; L<='1'; A<='1';
763                         when "01000" => n_state <= s58; L<='1'; A<='1';
764                         when "10000" => n_state <= s58; L<='1'; A<='1';
765                         when others =>
766                     end case;
767                 when s55 =>
768                     case X is
769                         when "00000" => n_state <= s56; L<='1'; A<='1';
770                         when "00010" => n_state <= s55; L<='1'; A<='1';
771                         when others =>
772                     end case;
773                 when s56 =>
774                     case X is
775                         when "00000" => n_state <= s56; L<='1'; A<='1';
776                         when "00001" => n_state <= s58; L<='1'; A<='1';
777                         when "00010" => n_state <= s58; L<='1'; A<='1';
778                         when "00100" => n_state <= s58; L<='1'; A<='1';
779                         when "01000" => n_state <= s58; L<='1'; A<='1';
780                         when "10000" => n_state <= s57; L<='1'; A<='1';
781                         when others =>
782                     end case;
783                 when s57 =>
784                     case X is
785                         when "00000" => n_state <= s0; L<='0'; A<='0';
786                         when "10000" => n_state <= s57; L<='1'; A<='1';
787                         when others =>
788                     end case;
789
790         --Unlatched Alarm Reset State
791                 when s58 =>
792                     case X is
793                         when "00000" => n_state <= s35; L<='1'; A<='1';
```

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794                         when "00001" => n_state <= s58; L<='1'; A<='1';
795                         when "00010" => n_state <= s58; L<='1'; A<='1';
796                         when "00100" => n_state <= s58; L<='1'; A<='1';
797                         when "01000" => n_state <= s58; L<='1'; A<='1';
798                         when "10000" => n_state <= s58; L<='1'; A<='1';
799                         when others =>
800                     end case;
801
802             --Unlatched Unarmed Reset state
803                 when s59 => n_state <= s0; L<='0'; A<='0';
804                 when others =>
805               end case;--End of H = '0'
806
807          when others =>
808       end case; --End of H cases
809
810     end process;
811
812   Process(p_state)
813   begin
814      if (p_state = s0) then
815         r_state<= '1'; l_state<= '0'; a_state <= '0';
816          elsif(p_state = s12) then
817         r_state<= '0'; l_state<= '1'; a_state <= '0';
818      elsif(p_state = s35) then
819         r_state<= '0'; l_state<= '0'; a_state <= '1';
820      Else
821          r_state<= '0'; l_state<= '0'; a_state <= '0';
822      end if;
823   end process;
824
825
826   end Behavioral;
```