

```
1: /*
2:   ETHERNET SWITCH
3:   BY ROGER REHR w3sz
4:
5:   Ethernet shield connected to pins 10, 11, 12, 13
6:   This requires a MEGA as it used 3196 bytes of Dynamic Memory
7: */
8:
9: #include <Ethernet.h> //for ethernet port
10: #include <string.h> // for string handling
11:
12: String commandInputString = "";
13: String serIn;
14: String serOut1;
15: String serOut2;
16: String serOut3;
17: String serOut4;
18: String serOut5;
19: String serOut6;
20: String serOut7;
21: String serOut8;
22: String serOut9;
23: String serOut10;
24: String serOut11;
25: String serOut12;
26: String serOut13;
27: String serOut14;
28: String serOut15;
29: String serOut16;
30:
31: const int ON = 0;
32: const int OFF = 1;
33:
34: // Enter MAC address and IP address for Arduino beOFF.
35: // The IP address is dependent on your local network:
36: byte mac[] = { 0x90, 0xAA, 0xBB, 0xCC, 0xDA, 0x02 };
37: IPAddress ip(192, 168, 1, 176); //<< ENTER YOUR IP ADDRESS HERE <<
38:
39: // Initialize the Ethernet server library
40: // We'll use port 80 for HTTP):
41: EthernetServer server(80);
42: EthernetClient client;
43:
44: const int PinR1 = 2; //number of Relay 1 pin
45: const int PinR2 = 3; //number of Relay 2 pin
46: const int PinR3 = 4; //number of Relay 3 pin
47: const int PinR4 = 5; //number of Relay 4 pin
48: const int PinR5 = 6; //number of Relay 5 pin
49: const int PinR6 = 8; //number of Relay 6 pin
50: const int PinR7 = A5; //number of Relay 7 pin
51: const int PinR8 = A4; //number of Relay 8 pin
52: const int PinR9 = A3; //number of Relay 9 pin
53: const int PinR10 = A2; //number of Relay 10 pin
54: const int PinR11 = A1; //number of Relay 11 pin
55: const int PinR12 = A0; //number of Relay 12 pin
56: const int PinR13 = A8; //number of Relay 13 pin
57: const int PinR14 = A9; //number of Relay 14 pin
58: const int PinR15 = A10; //number of Relay 15 pin
59: const int PinR16 = A11; //number of Relay 16 pin
60:
61: void setup()
62: {
63:   // initialize GPIO pins as output pins
64:   pinMode(PinR1, OUTPUT);
65:   pinMode(PinR2, OUTPUT);
66:   pinMode(PinR3, OUTPUT);
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67:   pinMode(PinR4, OUTPUT);
68:   pinMode(PinR5, OUTPUT);
69:   pinMode(PinR6, OUTPUT);
70:   pinMode(PinR7, OUTPUT);
71:   pinMode(PinR8, OUTPUT);
72:   pinMode(PinR9, OUTPUT);
73:   pinMode(PinR10, OUTPUT);
74:   pinMode(PinR11, OUTPUT);
75:   pinMode(PinR12, OUTPUT);
76:   pinMode(PinR13, OUTPUT);
77:   pinMode(PinR14, OUTPUT);
78:   pinMode(PinR15, OUTPUT);
79:   pinMode(PinR16, OUTPUT);
80:
81:   //initialize all GPIO pin values to OFF
82:   digitalWrite(PinR1, OFF);
83:   digitalWrite(PinR2, OFF);
84:   digitalWrite(PinR3, OFF);
85:   digitalWrite(PinR4, OFF);
86:   digitalWrite(PinR5, OFF);
87:   digitalWrite(PinR6, OFF);
88:   digitalWrite(PinR7, OFF);
89:   digitalWrite(PinR8, OFF);
90:   digitalWrite(PinR9, OFF);
91:   digitalWrite(PinR10, OFF);
92:   digitalWrite(PinR11, OFF);
93:   digitalWrite(PinR12, OFF);
94:   digitalWrite(PinR13, OFF);
95:   digitalWrite(PinR14, OFF);
96:   digitalWrite(PinR15, OFF);
97:   digitalWrite(PinR16, OFF);
98:
99:   // start the Ethernet connection and the server and the serial port:
100:  Ethernet.begin(mac, ip);
101:  server.begin();
102:  Serial.begin(9600);
103:  Serial.println("Arduino Ethernet Device Switch");
104:  Serial.println("by W3SZ");
105:  Serial.println("Starting Server");
106:  Serial.println (Ethernet.localIP());
107:
108:
109: }
110:
111: //this routine reads the output pin values and reports them both through the
112: //serial port and to the HTML client
113: //it also creates the HTML buttons on the web page and defines what is sent to
114: //the HTML server when each button is clicked
115: void sendReply()
116: {
117:     //read all output pin values
118:     bool val = digitalRead(PinR1);
119:     Serial.println(val);
120:     if(val == ON)
121:     {
122:         serOut1 = F("<input type=button value = 'ON' style = 'background-
123:             color:lime;'>");
124:     }
125:     else if (val == OFF)
126:     {
127:         serOut1 = F("<input type=button value = 'OFF' style = 'background-
128:             color:silver;'>");
129:     }
130:     val = digitalRead(PinR2);
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129:         Serial.println(val);
130:         if(val == ON)
131:         {
132:             serOut2 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
133:         }
134:         else if(val == OFF)
135:         {
136:             serOut2 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
137:         }
138:         val = digitalRead(PinR3);
139:         Serial.println(val);
140:         if(val == ON)
141:         {
142:             serOut3 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
143:         }
144:         else if(val == OFF)
145:         {
146:             serOut3 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
147:         }
148:         val = digitalRead(PinR4);
149:         Serial.println(val);
150:         if(val == ON)
151:         {
152:             serOut4 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
153:         }
154:         else if(val == OFF)
155:         {
156:             serOut4 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
157:         }
158:         val = digitalRead(PinR5);
159:         Serial.println(val);
160:         if(val == ON)
161:         {
162:             serOut5 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
163:         }
164:         else if(val == OFF)
165:         {
166:             serOut5 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
167:         }
168:         val = digitalRead(PinR6);
169:         Serial.println(val);
170:         if(val == ON)
171:         {
172:             serOut6 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
173:         }
174:         else if(val == OFF)
175:         {
176:             serOut6 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
177:         }
178:         val = digitalRead(PinR7);
179:         Serial.println(val);
180:         if(val == ON)
181:         {
182:             serOut7 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
183:         }
```

```
184:         else if(val == OFF)
185:         {
186:             serOut7 = F("<input type=button value = 'OFF' style = 'background-
                color:silver;'>");
187:         }
188:         val = digitalRead(PinR8);
189:         Serial.println(val);
190:         if(val == ON)
191:         {
192:             serOut8 = F("<input type=button value = 'ON' style = 'background-
                color:lime;'>");
193:         }
194:         else if(val == OFF)
195:         {
196:             serOut8 = F("<input type=button value = 'OFF' style = 'background-
                color:silver;'>");
197:         }
198:         val = digitalRead(PinR9);
199:         Serial.println(val);
200:         if(val == ON)
201:         {
202:             serOut9 = F("<input type=button value = 'ON' style = 'background-
                color:lime;'>");
203:         }
204:         else if(val == OFF)
205:         {
206:             serOut9 = F("<input type=button value = 'OFF' style = 'background-
                color:silver;'>");
207:         }
208:         val = digitalRead(PinR10);
209:         Serial.println(val);
210:         if(val == ON)
211:         {
212:             serOut10 = F("<input type=button value = 'ON' style = 'background-
                color:lime;'>");
213:         }
214:         else if(val == OFF)
215:         {
216:             serOut10 = F("<input type=button value = 'OFF' style = 'background-
                color:silver;'>");
217:         }
218:         val = digitalRead(PinR11);
219:         Serial.println(val);
220:         if(val == ON)
221:         {
222:             serOut11 = F("<input type=button value = 'ON' style = 'background-
                color:lime;'>");
223:         }
224:         else if(val == OFF)
225:         {
226:             serOut11 = F("<input type=button value = 'OFF' style = 'background-
                color:silver;'>");
227:         }
228:         val = digitalRead(PinR12);
229:         Serial.println(val);
230:         if(val == ON)
231:         {
232:             serOut12 = F("<input type=button value = 'ON' style = 'background-
                color:lime;'>");
233:         }
234:         else if(val == OFF)
235:         {
236:             serOut12 = F("<input type=button value = 'OFF' style = 'background-
                color:silver;'>");
237:         }
238:         val = digitalRead(PinR13);
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```
239:         Serial.println(val);
240:         if(val == ON)
241:         {
242:             serOut13 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
243:         }
244:         else if(val == OFF)
245:         {
246:             serOut13 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
247:         }
248:         val = digitalRead(PinR14);
249:         Serial.println(val);
250:         if(val == ON)
251:         {
252:             serOut14 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
253:         }
254:         else if(val == OFF)
255:         {
256:             serOut14 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
257:         }
258:         val = digitalRead(PinR15);
259:         Serial.println(val);
260:         if(val == ON)
261:         {
262:             serOut15 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
263:         }
264:         else if(val == OFF)
265:         {
266:             serOut15 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
267:         }
268:         val = digitalRead(PinR16);
269:         Serial.println(val);
270:         if(val == ON)
271:         {
272:             serOut16 = F("<input  type=button value = 'ON' style = 'background-
                color:lime;'>");
273:         }
274:         else if(val == OFF)
275:         {
276:             serOut16 = F("<input  type=button value = 'OFF' style = 'background-
                color:silver;'>");
277:         }
278:
279:         client.println("HTTP/1.1 200 OK");
280:         client.println("Content-Type: text/html");
281:         client.println();
282:         client.println("<!DOCTYPE HTML>");
283:         client.println("<html>");
284:         client.println("<HEAD>");
285:         client.println("<TITLE>W3SZ Ethernet Relay Switch</TITLE>");
286:         client.println("</HEAD>");
287:         client.println("<body>");
288:         client.println("<br />");
289:         client.println("<H1>W3SZ Ethernet Relay Control</H1>");
290:         client.println("<H2>Click On Relay Buttons To Change State</H2>");
291:         client.println("<br />");
292:         client.println("<input  type=button value = 'GET STATUS' onmousedown=
                location.href='/~STATUS$'>");
293:         client.println("<br />");
294:         client.println("<br />");
295:         client.println("<br />");
```

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296:         client.println("<style>");
297:
298:         client.println("table, th, td {border-collapse: collapse;}");
299:         client.println("}");
300:         client.println("th, td {");
301:         client.println("padding: 5px;");
302:         client.println("}");
303:
304:         client.println("table {");
305:         client.println("width: 100%;");
306:         client.println("}");
307:         client.println("</style>");
308:         client.println("<table>");
309:         client.println("<tr style='border-top:2px solid #f00; border-left:2px
            solid #f00; border-right:2px solid #f00;'>");
310:         client.println("<td>");
311:         client.println("<input type=button value = 'Relay 1 ON' onmousedown=
            location.href='/~1$'>");
312:         client.println("<input type=button value = 'Relay 1 OFF' onmousedown=
            location.href='/~100$'>");
313:
314:         client.println("</td>");
315:         client.println("<td>");
316:         client.println("<input type=button value = 'Relay 2 ON' onmousedown=
            location.href='/~2$'>");
317:         client.println("<input type=button value = 'Relay 2 OFF' onmousedown=
            location.href='/~200$'>");
318:         client.println("</td>");
319:         client.println("<td>");
320:         client.println("<input type=button value = 'Relay 3 ON' onmousedown=
            location.href='/~3$'>");
321:         client.println("<input type=button value = 'Relay 3 OFF' onmousedown=
            location.href='/~300$'>");
322:         client.println("</td>");
323:         client.println("<td>");
324:         client.println("<input type=button value = 'Relay 4 ON' onmousedown=
            location.href='/~4$'>");
325:         client.println("<input type=button value = 'Relay 4 OFF' onmousedown=
            location.href='/~400$'>");
326:         client.println("</td>");
327:         client.println("</tr>");
328:
329:         client.println("<tr style='border-bottom:2px solid #f00; border-left:2
            px solid #f00; border-right:2px solid #f00;'>");
330:         client.println("<td>");
331:         client.println(serOut1);
332:         client.println("</td>");
333:         client.println("<td>");
334:         client.println(serOut2);
335:         client.println("</td>");
336:         client.println("<td>");
337:         client.println(serOut3);
338:         client.println("</td>");
339:         client.println("<td>");
340:         client.println(serOut4);
341:         client.println("</td>");
342:         client.println("</tr>");
343:
344:         client.println("<tr style='border-top:2px solid #f00; border-left:2px
            solid #f00; border-right:2px solid #f00;'>");
345:         client.println("<td>");
346:         client.println("<input type=button value = 'Relay 5 ON' onmousedown=
            location.href='/~5$'>");
347:         client.println("<input type=button value = 'Relay 5 OFF' onmousedown=
            location.href='/~500$'>");
348:         client.println("</td>");
```

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349:         client.println("<td>");
350:         client.println("<input type=button value = 'Relay 6 ON' onmousedown=
           location.href='/~6$'>");
351:         client.println("<input type=button value = 'Relay 6 OFF' onmousedown=
           location.href='/~600$'>");
352:         client.println("</td>");
353:         client.println("<td>");
354:         client.println("<input type=button value = 'Relay 7 ON' onmousedown=
           location.href='/~7$'>");
355:         client.println("<input type=button value = 'Relay 7 OFF' onmousedown=
           location.href='/~700$'>");
356:         client.println("</td>");
357:         client.println("<td>");
358:         client.println("<input type=button value = 'Relay 8 ON' onmousedown=
           location.href='/~8$'>");
359:         client.println("<input type=button value = 'Relay 8 OFF' onmousedown=
           location.href='/~800$'>");
360:         client.println("</td>");
361:         client.println("</tr>");
362:
363:         client.println("<tr style='border-bottom:2px solid #f00; border-left:2
           px solid #f00; border-right:2px solid #f00;'>");
364:         client.println("<td>");
365:         client.println(serOut5);
366:         client.println("</td>");
367:         client.println("<td>");
368:         client.println(serOut6);
369:         client.println("</td>");
370:         client.println("<td>");
371:         client.println(serOut7);
372:         client.println("</td>");
373:         client.println("<td>");
374:         client.println(serOut8);
375:         client.println("</td>");
376:         client.println("</tr>");
377:
378:         client.println("<tr style='border-top:2px solid #f00; border-left:2px
           solid #f00; border-right:2px solid #f00;'>");
379:         client.println("<td>");
380:         client.println("<input type=button value = 'Relay 9 ON' onmousedown=
           location.href='/~9$'>");
381:         client.println("<input type=button value = 'Relay 9 OFF' onmousedown=
           location.href='/~900$'>");
382:         client.println("</td>");
383:         client.println("<td>");
384:         client.println("<input type=button value = 'Relay 10 ON' onmousedown=
           location.href='/~10$'>");
385:         client.println("<input type=button value = 'Relay 10 OFF' onmousedown=
           location.href='/~1000$'>");
386:         client.println("</td>");
387:         client.println("<td>");
388:         client.println("<input type=button value = 'Relay 11 ON' onmousedown=
           location.href='/~11$'>");
389:         client.println("<input type=button value = 'Relay 11 OFF' onmousedown=
           location.href='/~1100$'>");
390:         client.println("</td>");
391:         client.println("<td>");
392:         client.println("<input type=button value = 'Relay 12 ON' onmousedown=
           location.href='/~12$'>");
393:         client.println("<input type=button value = 'Relay 12 OFF' onmousedown=
           location.href='/~1200$'>");
394:         client.println("</td>");
395:         client.println("</tr>");
396:
397:         client.println("<tr style='border-bottom:2px solid #f00; border-left:2
           px solid #f00; border-right:2px solid #f00;'>");
```

```
398:         client.println("<td>");
399:         client.println(serOut9);
400:         client.println("</td>");
401:         client.println("<td>");
402:         client.println(serOut10);
403:         client.println("</td>");
404:         client.println("<td>");
405:         client.println(serOut11);
406:         client.println("</td>");
407:         client.println("<td>");
408:         client.println(serOut12);
409:         client.println("</td>");
410:         client.println("</tr>");
411:
412:         client.println("<tr style='border-top:2px solid #f00; border-left:2px
            solid #f00; border-right:2px solid #f00;'>");
413:         client.println("<td>");
414:         client.println("<input type=button value = 'Relay 13 ON' onmousedown=
            location.href='/~13$'>");
415:         client.println("<input type=button value = 'Relay 13 OFF' onmousedown=
            location.href='/~1300$'>");
416:         client.println("</td>");
417:         client.println("<td>");
418:         client.println("<input type=button value = 'Relay 14 ON' onmousedown=
            location.href='/~14$'>");
419:         client.println("<input type=button value = 'Relay 14 OFF' onmousedown=
            location.href='/~1400$'>");
420:         client.println("</td>");
421:         client.println("<td>");
422:         client.println("<input type=button value = 'Relay 15 ON' onmousedown=
            location.href='/~15$'>");
423:         client.println("<input type=button value = 'Relay 15 OFF' onmousedown=
            location.href='/~1500$'>");
424:         client.println("</td>");
425:         client.println("<td>");
426:         client.println("<input type=button value = 'Relay 16 ON' onmousedown=
            location.href='/~16$'>");
427:         client.println("<input type=button value = 'Relay 16 OFF' onmousedown=
            location.href='/~1600$'>");
428:         client.println("</td>");
429:         client.println("</tr>");
430:
431:         client.println("<tr style='border-bottom:2px solid #f00; border-left:2
            px solid #f00; border-right:2px solid #f00;'>");
432:         client.println("<td>");
433:         client.println(serOut13);
434:         client.println("</td>");
435:         client.println("<td>");
436:         client.println(serOut14);
437:         client.println("</td>");
438:         client.println("<td>");
439:         client.println(serOut15);
440:         client.println("</td>");
441:         client.println("<td>");
442:         client.println(serOut16);
443:         client.println("</td>");
444:         client.println("</tr>");
445:
446:         client.println("</table>");
447:
448:
449:         client.println("</body>");
450:         client.println("</html>");
451:         // pause to give the browser time to receive the data
452:         delay(5);
453:         // close the connection:
```



```
454:     client.stop();
455:
456:
457: }
458:
459: //this is the main program loop.
460: //it listens for an HTML client and when it gets input from the client it builds
    a string from the client's input
461: //it then parses the input and if it finds a valid command in the input, it uses
    that command to set the status of
462: //the digital output pin referenced by that command
463: //it reports the command received to the serial monitor and
464: //it calls the function sendReply which reads the output pin values and reports
    them both via serial port and HTML
465: //and creates the webpage with the buttons and the relay status displays
466: void loop()
467: {
468:     // listen for incoming client
469:     client = server.available();
470:     if (client) {
471:         while (client.connected()) {
472:             char c = client.read();
473:             commandInputString += c; //append latest character received to string
474:             if (c == '\n')
475:             {
476:                 //Checks for the URL string beginning with '~' and ending with '$'
477:                 int stringStart = commandInputString.indexOf('~');
478:                 int stringEnd = commandInputString.indexOf('$');
479:                 String commandOut = commandInputString.substring(1 + stringStart,
                    stringEnd);
480:                 Serial.print("Command is: ");
481:                 Serial.println(commandOut);
482:                 Serial.println(" ");
483:
484:                 if (commandOut == "1") {
485:                     digitalWrite(PinR1, ON);
486:                     sendReply();
487:                 }
488:                 else if (commandOut == "100") {
489:                     digitalWrite(PinR1, OFF);
490:                     sendReply();
491:                 }
492:
493:                 else if (commandOut == "2") {
494:                     digitalWrite(PinR2, ON);
495:                     sendReply();
496:                 }
497:                 else if (commandOut == "200") {
498:                     digitalWrite(PinR2, OFF);
499:                     sendReply();
500:                 }
501:
502:                 else if (commandOut == "3") {
503:                     digitalWrite(PinR3, ON);
504:                     sendReply();
505:                 }
506:                 else if (commandOut == "300") {
507:                     digitalWrite(PinR3, OFF);
508:                     sendReply();
509:                 }
510:
511:                 else if (commandOut == "4") {
512:                     digitalWrite(PinR4, ON);
513:                     sendReply();
514:                 }
515:                 else if (commandOut == "400") {
```

```
516:         digitalWrite(PinR4, OFF);
517:         sendReply();
518:     }
519:
520:     else if (commandOut == "5") {
521:         digitalWrite(PinR5, ON);
522:         sendReply();
523:     }
524:     else if (commandOut == "500") {
525:         digitalWrite(PinR5, OFF);
526:         sendReply();
527:     }
528:
529:     else if (commandOut == "6") {
530:         digitalWrite(PinR6, ON);
531:         sendReply();
532:     }
533:     else if (commandOut == "600") {
534:         digitalWrite(PinR6, OFF);
535:         sendReply();
536:     }
537:
538:     else if (commandOut == "7") {
539:         digitalWrite(PinR7, ON);
540:         sendReply();
541:     }
542:     else if (commandOut == "700") {
543:         digitalWrite(PinR7, OFF);
544:         sendReply();
545:     }
546:
547:     else if (commandOut == "8") {
548:         digitalWrite(PinR8, ON);
549:         sendReply();
550:     }
551:     else if (commandOut == "800") {
552:         digitalWrite(PinR8, OFF);
553:         sendReply();
554:     }
555:
556:     else if (commandOut == "9") {
557:         digitalWrite(PinR9, ON);
558:         sendReply();
559:     }
560:     else if (commandOut == "900") {
561:         digitalWrite(PinR9, OFF);
562:         sendReply();
563:     }
564:
565:     else if (commandOut == "10") {
566:         digitalWrite(PinR10, ON);
567:         sendReply();
568:     }
569:     else if (commandOut == "1000") {
570:         digitalWrite(PinR10, OFF);
571:         sendReply();
572:     }
573:
574:     else if (commandOut == "11") {
575:         digitalWrite(PinR11, ON);
576:         sendReply();
577:     }
578:     else if (commandOut == "1100") {
579:         digitalWrite(PinR11, OFF);
580:         sendReply();
581:     }
```

```
582:
583:     else if (commandOut == "12") {
584:         digitalWrite(PinR12, ON);
585:         sendReply();
586:     }
587:     else if (commandOut == "1200") {
588:         digitalWrite(PinR12, OFF);
589:         sendReply();
590:     }
591:
592:
593:     else if (commandOut == "13") {
594:         digitalWrite(PinR13, ON);
595:         sendReply();
596:     }
597:     else if (commandOut == "1300") {
598:         digitalWrite(PinR13, OFF);
599:         sendReply();
600:     }
601:
602:     else if (commandOut == "14") {
603:         digitalWrite(PinR14, ON);
604:         sendReply();
605:     }
606:     else if (commandOut == "1400") {
607:         digitalWrite(PinR14, OFF);
608:         sendReply();
609:     }
610:
611:     else if (commandOut == "15") {
612:         digitalWrite(PinR15, ON);
613:         sendReply();
614:     }
615:     else if (commandOut == "1500") {
616:         digitalWrite(PinR15, OFF);
617:         sendReply();
618:     }
619:
620:     else if (commandOut == "16") {
621:         digitalWrite(PinR16, ON);
622:         sendReply();
623:     }
624:     else if (commandOut == "1600") {
625:         digitalWrite(PinR16, OFF);
626:         sendReply();
627:     }
628:
629:     else if (commandOut == "STATUS") {
630:         sendReply();
631:     }
632:     else
633:     {
634:         String HTMString = "Command Not Recognized: ";
635:         Serial.println(commandOut);
636:         Serial.println(HTMString);
637:         sendReply();
638:     }
639:
640:     commandInputString = "";
641:     commandOut = "";
642:     c=' ';
643:
644:     }
645: }
646: }
647: }
```

648: