

# AUTO-TRACKING AND CONTROL OF LIGHT CHASING VEHICLE USING IOT

Deepika.T<sup>1</sup>, Srividhya.K<sup>2</sup>, Madhumathi.S<sup>3</sup>, Sigothini.R<sup>4</sup>, Arunkumar M<sup>5</sup>

<sup>1</sup>Department of ECE, Sengunthar Engineering College, Tiruchengode, (India)

<sup>2</sup>Department of ECE, Sengunthar Engineering College, Tiruchengode, (India)

<sup>3</sup>Department of ECE, Sengunthar Engineering College, Tiruchengode, (India)

<sup>4</sup>Department of ECE, Sengunthar Engineering College, Tiruchengode, (India)

<sup>5</sup>Professor, Department of ECE, Sengunthar Engineering College, Tiruchengode, (India)

## ABSTRACT

This paper mainly discusses the application of Internet of Things (IoT) technologies; all the things around us are getting smarter. This project mainly discusses the application of Internet of Things (IoT) in mobile vehicle tracking. We combine embedded control and IoT technology to design and develop a smart light chasing vehicle that automatically chases the light source and tracks its moving direction and moving path. This light-chasing vehicle can be used with Arduino embedded control technology combined with four-azimuth light sensing components. These components are used to design and develop a smart chasing vehicle that can automatically chase the light source from eight directions (N, E, W, S, NE, NW, SE, SW) and record the sensing value and moving direction. In addition, through the IoT remote WiFi wireless communication function, light source parameters and the vehicle moving direction can be transmitted. The real-time vehicle tracking system is to be implemented to monitor the vehicle's live location as well as vehicle tracking records through GPS (Global Positioning System).

## 1. INTRODUCTION

The Internet of Things (IoT) refers to a message connection and switching network formed by physical objects, such as vehicles, machines, household appliances, etc., through embedded control sensors and API devices. IoT can digitize the real world and has a wide range of applications. Its main application areas include transportation and logistics, industrial manufacturing, health care, smart environments (home, office, and factory), individuals and society, with a very broad market and application prospects. In order to explore the application of IoT technology in mobile vehicle tracking, this study combines Arduino embedded control and IoT communication technology. On the one hand, the four-direction light sensing

components are used to design and develop a smart chasing vehicle that can automatically chase the light source from eight directions and record the sensing value and moving direction. In this paper, the system architecture and system development of this automated light-chasing vehicle will be described, and topics such as the light-chasing control process of the vehicle and the algorithm for determining the direction of movement when displaying the moving path will be discussed.

### 1.1 INTERNET OF THINGS (IOT)

The **Internet of Things (IoT)** is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the

ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. Wi-Fi provides higher data rates for multimedia access as compared to both zigbee and Bluetooth which provides lower data transfer rates.

## 2. SYSTEM DESIGN

The system architecture of this automated light-chasing vehicle is shown in Fig., The functions of each component are described as follows:

### 2.1 MOTOR DRIVEN UNIT:

A dual-motor driven board is used to control the forward and reverse movements and the rotation speed of the left and right wheels of the vehicle body.

### 2.2 ARDUINO EMBEDDED CONTROL UNIT:

An Arduino control board that accepts Arduino code, performs various input/output operations, and performs decision, operation, and control actions. This is the embedded control core of the entire light-chasing vehicle. Light Sensing Unit: The front, back, left and right sides of the vehicle body are equipped with a photo resistance element for detecting the light source illumination in the front, rear, left and right directions of the vehicle body.

### 2.3 IoT COMMUNICATION UNIT:

This is a PlayRobot IoT maker board that supports remote WiFi wireless communication and control functions, and transmits the ambient light source parameters and moving directions monitored and recorded by the light-chasing vehicle to the IoT host machine.

### 2.4 ULTRASONIC SENSOR:

It transmits the high frequency sound wave to an object and then measure the reflected echo off the target. Vehicle parking sensors are equipped with this types of sensors.

### 2.5 GPS(Global Positioning System):

A GPS tracking system uses the global navigation satellite system network. This network incorporates a range of satellites that use microwave signals that are transmitted to GPS device to give information on location, speed, time and direction.

### 2.6 PROPOSED SOLUTION FOR THE HARDWARE PART:

The solution that we have adopted consists of the exploitation of the Arduino Uno controller. It is a single nano computer card ARM processor designed by designer David Braben video games, as part of its foundation "Arduino uno controller". The following photo presents the Arduino uno controller.

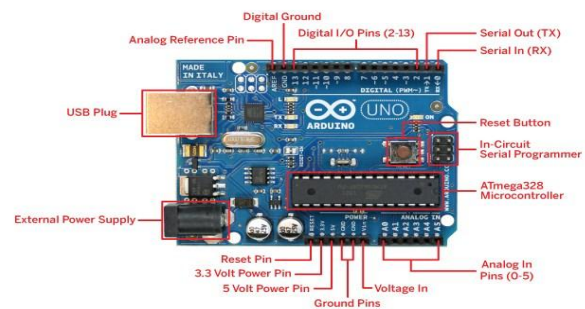


Fig-5: Arduino Uno controller

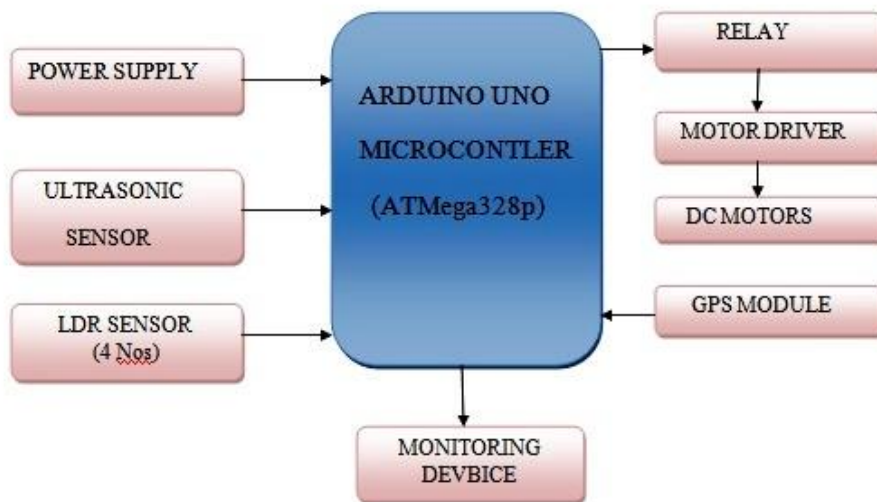
- **Arduino Uno controller Model.** A 700 MHz ARM-based Linux computer with 512 MB RAM. Ten programmable GPIO pins control the five relays: simply pulse the on or off coil for ~50ms. Another GPIO controls the IR diode.
- **IDE cable connector.** I cut up an old 40-pin IDE connector to connect to the 26-pin GPIO header.
- **DPDT latching signal relays.** Each relay controls left and right channels (hence dual poles). I opted for two-coil

relays, so I could activate one coil to turn the relay on and the other coil to turn it off.

- **ULN2003A ICs to drive the relays.** The Arduino Uno controller's GPIOs can't drive the relays directly, so we control them with this transistor array. Each chip has 7 NPN Darlington pairs. It also has built-in fly back diodes that will dissipate the inductive kickback from the relay coils.

- **Stick-on IR diode.** I had this emitter lying around. It came with a long cable that terminates in a mono 3.5mm headphone jack. I cut off a female headphone jack from a patch cable to make a plug for this and wired a 270 ohm current-limiting resistor to this.

### 3. BLOCK DIAGRAM



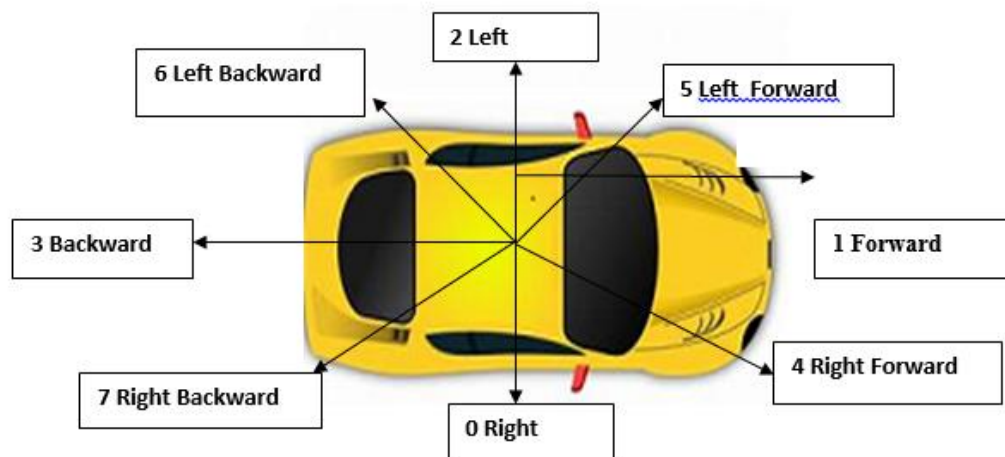
**Fig ; Entity structure of Light-chasing vehicle**

#### 4. LIGHT-CHASING CONTROL PROCESS

The light-chasing vehicle is provided with a photo resistance element on the front, rear, left and right sides of the vehicle body. It can be used to detect the illumination of the light source in the front, back, left and right directions of the car body. In order to enable the vehicle to perform precise movement control, the study has planned eight different directions of movement, as shown we developed an Arduino embedded program to perform the light-chasing control operation of the vehicle. The user can first set a threshold, which

will be determined according to the actual environment. In high brightness environments, the threshold must be increased, while in low brightness environments, the threshold must be reduced. The system first detects the photometric values of the front, back, left, and right directions, sorting and calculating the number of overthreshold. If it is a front/back (about 90 degrees). When two luminosities exceed the threshold, if the two are in a front-rear or left-right relationship do not move. Otherwise, select the middle direction of the time (about 45 degrees). For

example, if the forward and right to the Right Forward direction.



## 5. GLOBAL POSITIONING SYSTEM

### (GPS)

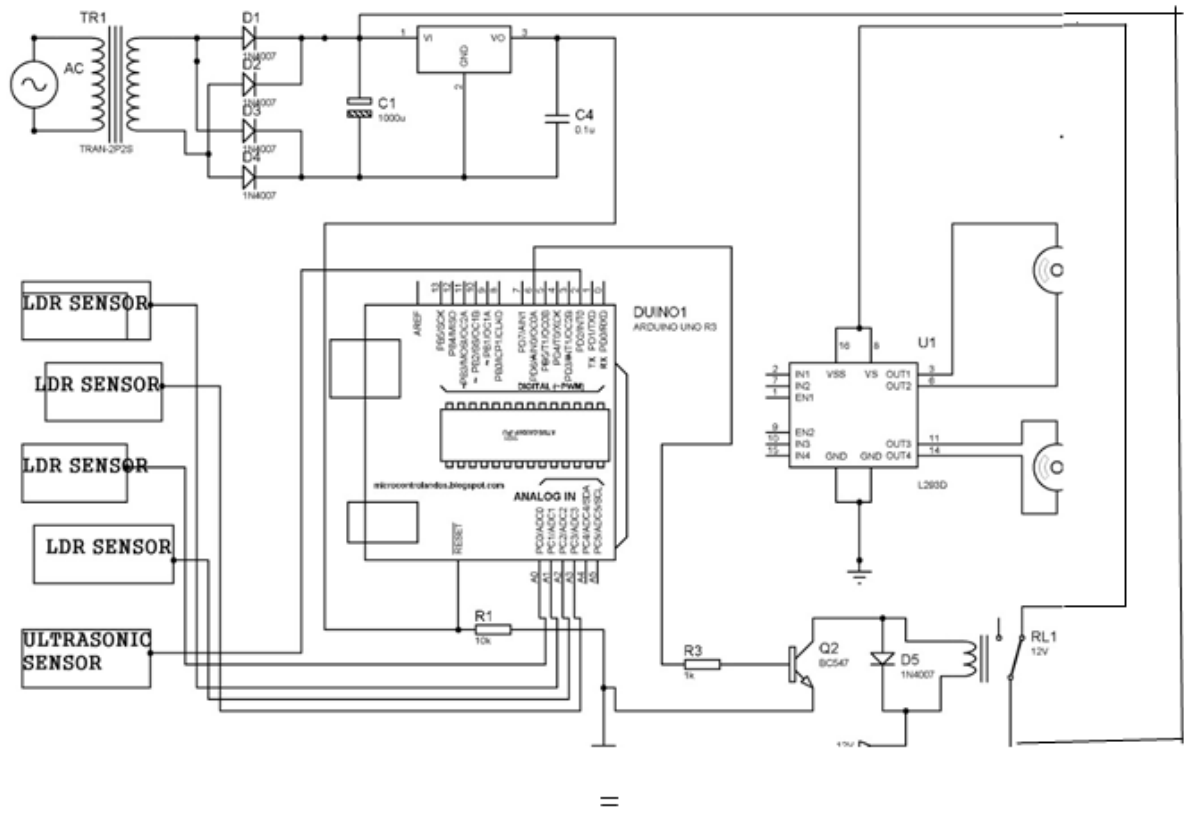
The Global Positioning System consists of 24 satellites, that circle the globe once every 12 hours, to provide worldwide position, time and velocity information. GPS makes it possible to identify locations on the earth by measuring distance from the satellites. GPS allows you to record or create locations from places on the earth and help you navigate to and from those places.

When a GPS receiver is turned on, it first downloads orbit information of all the satellites. This process, the first time, can take as long as 12.5 minutes, but once this information is downloaded, it is stored in the receiver's memory for future use. Even though the GPS receiver knows the precise location of the satellites in space, it still needs to know the distance from each satellite it is receiving a signal from. That distance is calculated, by the receiver, by multiplying the velocity of the transmitted signal by the time it takes the signal to reach the receiver. The receiver already knows the velocity, which is the speed of a radio wave or 186,000 miles per second (the speed of light). To determine the time part of the formula, the receiver matches the satellite's transmitted code to its own

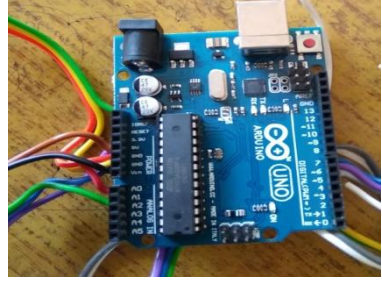
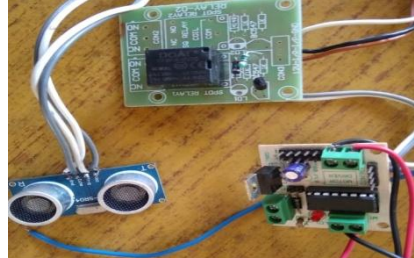
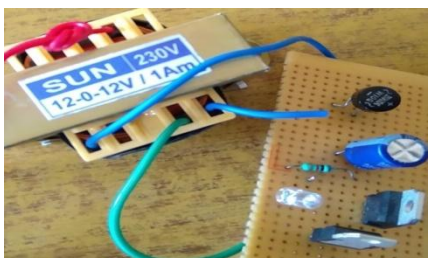
code, and by comparing them determines how much it needs to delay its code to match the satellite's code. This delayed time is multiplied by the speed of light to get the distance. The GPS receiver's clock is less accurate than the atomic clock in the satellite, therefore, each distance measurement must be corrected to account for the GPS receiver's internal clock error.

Real-time DGPS employs a second, stationary GPS receiver at a precisely measured spot (usually established through traditional survey methods). This receiver corrects any errors found in the GPS signals, including atmospheric distortion, orbital anomalies, Selective Availability (when it existed), and other errors. A DGPS station is able to do this because its computer already knows its precise location, and can easily determine the amount of error provided by the GPS signals.

6. CIRCUIT DIAGRAM



7. RESULT



```

COM3
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
340
341
342
343
344
345
346
347
348
349
350
351
352
353
354
355
356
357
358
359
360
361
362
363
364
365
366
367
368
369
370
371
372
373
374
375
376
377
378
379
380
381
382
383
384
385
386
387
388
389
390
391
392
393
394
395
396
397
398
399
400
401
402
403
404
405
406
407
408
409
410
411
412
413
414
415
416
417
418
419
420
421
422
423
424
425
426
427
428
429
430
431
432
433
434
435
436
437
438
439
440
441
442
443
444
445
446
447
448
449
450
451
452
453
454
455
456
457
458
459
460
461
462
463
464
465
466
467
468
469
470
471
472
473
474
475
476
477
478
479
480
481
482
483
484
485
486
487
488
489
490
491
492
493
494
495
496
497
498
499
500
501
502
503
504
505
506
507
508
509
510
511
512
513
514
515
516
517
518
519
520
521
522
523
524
525
526
527
528
529
530
531
532
533
534
535
536
537
538
539
540
541
542
543
544
545
546
547
548
549
550
551
552
553
554
555
556
557
558
559
560
561
562
563
564
565
566
567
568
569
570
571
572
573
574
575
576
577
578
579
580
581
582
583
584
585
586
587
588
589
590
591
592
593
594
595
596
597
598
599
600
601
602
603
604
605
606
607
608
609
610
611
612
613
614
615
616
617
618
619
620
621
622
623
624
625
626
627
628
629
630
631
632
633
634
635
636
637
638
639
640
641
642
643
644
645
646
647
648
649
650
651
652
653
654
655
656
657
658
659
660
661
662
663
664
665
666
667
668
669
670
671
672
673
674
675
676
677
678
679
680
681
682
683
684
685
686
687
688
689
690
691
692
693
694
695
696
697
698
699
700
701
702
703
704
705
706
707
708
709
710
711
712
713
714
715
716
717
718
719
720
721
722
723
724
725
726
727
728
729
730
731
732
733
734
735
736
737
738
739
740
741
742
743
744
745
746
747
748
749
750
751
752
753
754
755
756
757
758
759
760
761
762
763
764
765
766
767
768
769
770
771
772
773
774
775
776
777
778
779
780
781
782
783
784
785
786
787
788
789
790
791
792
793
794
795
796
797
798
799
800
801
802
803
804
805
806
807
808
809
810
811
812
813
814
815
816
817
818
819
820
821
822
823
824
825
826
827
828
829
830
831
832
833
834
835
836
837
838
839
840
841
842
843
844
845
846
847
848
849
850
851
852
853
854
855
856
857
858
859
860
861
862
863
864
865
866
867
868
869
870
871
872
873
874
875
876
877
878
879
880
881
882
883
884
885
886
887
888
889
890
891
892
893
894
895
896
897
898
899
900
901
902
903
904
905
906
907
908
909
910
911
912
913
914
915
916
917
918
919
920
921
922
923
924
925
926
927
928
929
930
931
932
933
934
935
936
937
938
939
940
941
942
943
944
945
946
947
948
949
950
951
952
953
954
955
956
957
958
959
960
961
962
963
964
965
966
967
968
969
970
971
972
973
974
975
976
977
978
979
980
981
982
983
984
985
986
987
988
989
990
991
992
993
994
995
996
997
998
999
1000
    
```

```

COM3
1011
1012
1013
1014
1015
1016
1017
1018
1019
1020
1021
1022
1023
1024
1025
1026
1027
1028
1029
1030
1031
1032
1033
1034
1035
1036
1037
1038
1039
1040
1041
1042
1043
1044
1045
1046
1047
1048
1049
1050
1051
1052
1053
1054
1055
1056
1057
1058
1059
1060
1061
1062
1063
1064
1065
1066
1067
1068
1069
1070
1071
1072
1073
1074
1075
1076
1077
1078
1079
1080
1081
1082
1083
1084
1085
1086
1087
1088
1089
1090
1091
1092
1093
1094
1095
1096
1097
1098
1099
1100
1101
1102
1103
1104
1105
1106
1107
1108
1109
1110
1111
1112
1113
1114
1115
1116
1117
1118
1119
1120
1121
1122
1123
1124
1125
1126
1127
1128
1129
1130
1131
1132
1133
1134
1135
1136
1137
1138
1139
1140
1141
1142
1143
1144
1145
1146
1147
1148
1149
1150
1151
1152
1153
1154
1155
1156
1157
1158
1159
1160
1161
1162
1163
1164
1165
1166
1167
1168
1169
1170
1171
1172
1173
1174
1175
1176
1177
1178
1179
1180
1181
1182
1183
1184
1185
1186
1187
1188
1189
1190
1191
1192
1193
1194
1195
1196
1197
1198
1199
1200
1201
1202
1203
1204
1205
1206
1207
1208
1209
1210
1211
1212
1213
1214
1215
1216
1217
1218
1219
1220
1221
1222
1223
1224
1225
1226
1227
1228
1229
1230
1231
1232
1233
1234
1235
1236
1237
1238
1239
1240
1241
1242
1243
1244
1245
1246
1247
1248
1249
1250
1251
1252
1253
1254
1255
1256
1257
1258
1259
1260
1261
1262
1263
1264
1265
1266
1267
1268
1269
1270
1271
1272
1273
1274
1275
1276
1277
1278
1279
1280
1281
1282
1283
1284
1285
1286
1287
1288
1289
1290
1291
1292
1293
1294
1295
1296
1297
1298
1299
1300
1301
1302
1303
1304
1305
1306
1307
1308
1309
1310
1311
1312
1313
1314
1315
1316
1317
1318
1319
1320
1321
1322
1323
1324
1325
1326
1327
1328
1329
1330
1331
1332
1333
1334
1335
1336
1337
1338
1339
1340
1341
1342
1343
1344
1345
1346
1347
1348
1349
1350
1351
1352
1353
1354
1355
1356
1357
1358
1359
1360
1361
1362
1363
1364
1365
1366
1367
1368
1369
1370
1371
1372
1373
1374
1375
1376
1377
1378
1379
1380
1381
1382
1383
1384
1385
1386
1387
1388
1389
1390
1391
1392
1393
1394
1395
1396
1397
1398
1399
1400
1401
1402
1403
1404
1405
1406
1407
1408
1409
1410
1411
1412
1413
1414
1415
1416
1417
1418
1419
1420
1421
1422
1423
1424
1425
1426
1427
1428
1429
1430
1431
1432
1433
1434
1435
1436
1437
1438
1439
1440
1441
1442
1443
1444
1445
1446
1447
1448
1449
1450
1451
1452
1453
1454
1455
1456
1457
1458
1459
1460
1461
1462
1463
1464
1465
1466
1467
1468
1469
1470
1471
1472
1473
1474
1475
1476
1477
1478
1479
1480
1481
1482
1483
1484
1485
1486
1487
1488
1489
1490
1491
1492
1493
1494
1495
1496
1497
1498
1499
1500
    
```

## 8. CONCLUSIONS

This paper focuses on the application of Internet of Things technology in mobile vehicle tracking. Combining Arduino embedded control and IoT technology. We designed and developed a smart light-chasing vehicle that automatically chases the light source from eight directions and records the sensed values and direction of movement. In addition, we also developed a mobile path display system on the monitoring host, which can display the moving path of the vehicle according to the moving direction and sensing parameters transmitted by the light-chasing vehicle, and calculate the path length, movement, distance and other information. The future research can be further combined with cloud databases to provide big data analysis capabilities.

## REFERENCES

1. Ming- Sen Hu and Liang – Hsiu Chen, “The Application of Embedded Control and IOT Technology in the Automatic Light – Chasing Vehicles”, IEEE Eurasia Conference on IOT, Communication and Engineering , 2019
2. A.Anusha ,Syed Musthak Ahmed, “Vehicle Tracking And Monitoring System To Enhance The Safety And Security Driving Using IOT”, 2017 IEEE.
3. Zenon Chaczko, Frank Jiang and Benazir Ahmed, ” Road Vehicle Alert System Using IOT”, 2017 IEEE.
4. Gokhale, O. Bhat, S. Bhat, *Introduction to IOT*, International Advanced Research Journal in Science, Engineering and Technology, Vol.5, Issue 1, January 2018
5. A. Forrai, *Embedded Control System Design: A Model Based Approach*, Springer, 2012, DOI 10.1007/978-3-642-28595-0.
6. K. K Patel and S. M Patel, *Internet of Things-IOT: Definition, Characteristics, Architecture, Enabling Technologies, Application & Future Challenges*, International Journal of Engineering Science and Computing, May 2016, DOI10.4010/2016.1482.