

Illegal Border Cross Detection and Warning System Using IR Sensor and Node MCU

Afsana Tasnim, Shawan Shurid, and AKM Bahalul Haque

Abstract—We often find illegal immigrants moving from one country to another. By means of land these illegal immigrants move over the fence cut the border wires and moves to the other part of the land. What do you think our soldiers are not doing their job? It is not that actually. It is very difficult to watch consistently over the border. Soldiers have a limited vision to check around the whole land mass. So for them we have come up with a solution that we have built a device that will sense the presence of an intruder (illegal immigrant). This device will be installed over the fences. When an intruder passes over the fence this device will transmit the signal to the soldiers Smartphone app (BLYNK app). The soldier will be notified with the signal and after receiving the signal, the soldier can switch on the alarm and the emergency lights via the app. By this the soldiers in the camp will be alerted and can take their respective positions and arrest the intruder which was passing the border illegally. By this device we can alert the soldiers in the border to take more safety precautions to keep our country safe.

Index Terms—Node MCU ESP32, infrared sensor, Blynk app.

I. INTRODUCTION

A. Description

In Villages and in the areas near the border of a country people and the citizen of our country literally face many problems regarding security issues. People of different tribes of the other side of the border do come inside the border and attack our own civilians. Mostly they do a lot of harassment and they dominate over this people. They come and steal expensive items from the civilians. An estimate made in the year 2000 placed the total number of illegal Bangladeshi immigrants in India at 1.5 crore, with around 3 lakhs entering every year. The rule of thumb for such illegal immigrants is that for each illegal person caught four get through. While many immigrants have settled in the border areas, some have moved on, even to faraway places such as Mumbai and Delhi. The trip to India from Bangladesh is one of the cheapest in the world, with a trip costing around Rs.2000 (around \$30 US), which includes the fee for the “Tour Operator”. As Bangladeshi are cultural similar to the Bengali people in India, they are able to pass off as Indian citizens and settle down in any part of India to establish a far better future than they could in Bangladesh, for a very small price. This false identity can be bolstered with false documentation available for as little as Rs.200 (\$3

US) can even make them part of the vote bank. Although there is fancy or boundary for the safety purpose but it's not enough for security. The main purpose of the project is to enhance the border security electronically with automation and with that to reduce this kind of problems.

B. Solution

And Using this concept we can easily identify if any strangers entering the border. And by this system we can make our border soldiers more alert. We are here with a solution that will help them to stay more alert regarding the intruders entering over the border. We will provide a device which will be there across the pillars of the border to detect the presence of any intruder entering the country. If any intruder is found entering the system will alert the soldier to take action. And automatically a buzzer will turn on to alert the soldier base camps.

II. RESULTS LITERATURE REVIEW

Many analysts have been working on IOT and wireless sensor zones to provide the best security component. In this segment, we described different intrusion detection systems which are proposed in recent years. We have experienced different research papers and found what a were different security measures were used and what different strategy and thoughts overcome the problems.

A. Security Cameras

Security cameras are of numerous sorts with obviously many element inclinations. Settling on the camera for use in a home setting can be an overwhelming errand given the various alternatives. Despite the fact that these cameras are accessible in a wide scope of sizes, fields of view, the nature of pictures, and distinctive scopes of movement, surveillance cameras utilized in homes all give video pictures of events inside a field of view. The cameras can show the moves making place continuously or record everything for later view. A portion of the camera frameworks empowers clients to watch and control their surveillance cameras on the web. In Fig. 1 shows a surveillance camera. Surveillance cameras are sorted into those utilized inside and outside. Every one of the classifications has diverse camera styles. Further separation, all around, isn't essential on the grounds that the variety is evident amid the assessment of highlights. Surveillance cameras can either come as remain solitary units with introduced applications for observing the framework or as a major aspect of a bundle which clients buy in to for arrangement of home security.

Manuscript received February 30, 2020; revised May 9, 2020.

Afsana Tasnim, Shawan Shurid, and AKM Bahalul Haque are with North South University, Dhaka, Bangladesh (e-mail: {afsana.tasnim, shawan.shurid, bahalul.haque}@northsouth.edu).



Fig. 1. Surveillance cameras in the border areas which continuously keeps monitoring.

B. Microwaves

Ref. [1] Yaskawa and M. Kim to distinguish interlopers, there are strategies utilizing infrared sensors, camcorders, and microwave spatial qualities. Be that as it may, security encroachment and constrained identification extend are intrinsic issues in the infrared sensor and camcorder, individually. Notwithstanding when microwaves are utilized, the exactness breaks down except if high floods of intensity are impeded. Along these lines, in this exploration, gatecrasher recognition is performed by utilizing the spatiotemporal attributes of microwave multipath engendering. In this strategy, utilizing cluster beamforming at different defer taps improves the discovery likelihood.

C. GSM

Ref. [2] R. Newlin Shebiah, B. Deeksha, and S. Aparna proposed a system for joining the classifier into the course is done which in the long run guarantees the establishment extraction and pictures only the object of ability. The proposed structure is attempted with the animal database and if the wild animals are recognized, by then the messages are sent through the GSM shown in Fig. 2. The camera interminably records the scene and once the development is found, by then it gets the photos and uses the portrayal methods to perceive its trademark features. As such, when the animals are recognized as risky using the request strategies, the writings are sent to the ranchers to safeguard themselves and their cultivating territories. The inconvenience of this method is that it can't be most suitable to cover a far-reaching zone of land and isn't likely attainable for the area and following the development of various or social occasions of animals.

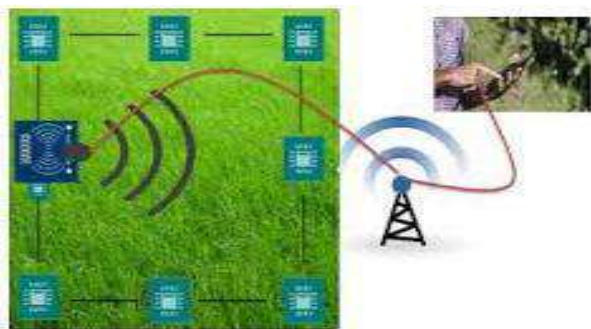


Fig. 2. Messages are sent through GSM to the farmers and the concerned people to safeguard themselves and their agricultural lands.

Ref. [3] Jyothsna and V. Prasad tells that Anomaly-based

identification is based with respect to characterizing the system functioning. The system performance is as per the predefined network, at that point it is acknowledged or else it triggers the occasion in the irregularity identification. The acknowledged system conduct is arranged or learned by the details of the system managers.

D. Keystroke

Ref. [4] There have been fixed approaches for login strategy like a Keystroke technique, titled "IMPROVED AUTHENTICATION MECHANISM USING KEYSTROKE ANALYSIS". Yet, the disadvantage of that was that on the off chance that the user is mentally irritated, at that point the rhythm of his typing speed might differ and can cause a failed login. Key stroke analysis shown in Fig. 3. The last result of the system will help the owner with protecting his system and the personal information of the owner by not enabling the intruder to reach the system as the system can shut down. Every one of the ports can be blocked and can carry on. To carry out this we will use the GSM module which will tell the user at whatever point somebody tries to reach the owner 's system.

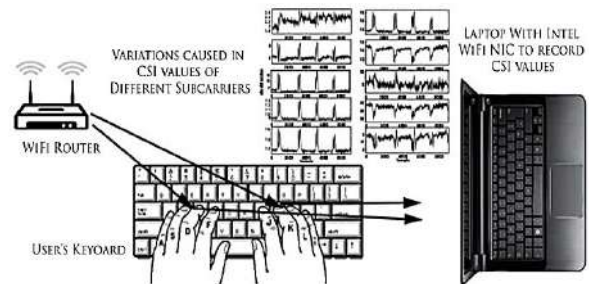


Fig. 3. Authentication mechanism using keystroke analysis.

E. Animal Detection

Ref. [5] Nidhi Daxini, Sachin Sharma and Rahul Patel discovered that real-time animal detection system will reduce animal intrusion. These are possible using Viola and one algorithm for facial element detection. The video is taken from a camera and is changed over into surrounding mount. Identifying various pictures, the database has a Positive and negative terminal. Positive pictures have detected animals and negative pictures have non-detected pictures. Here component extraction strategy is used and later testing the classifier checks the program. Even this may create the wrong outcome if extraction isn't done and in the event, we don't have a tremendous training set.

F. Human Intrusion Detection

In the approach, [6] the author works with human intrusion detection system using IR sensor, Wi-Fi module, Arduino, IOT, Atmega328p, and Temperature sensor. The Arduino Uno is used as the center of the system. It gets input at whatever point the movement is identified through PIR sensors. This system is acknowledged using PIR sensors [Fig. 4] to identify human existence MQ135 gas and smoke identifier, LM35 temperature sensor. The system is associated with the web using Wi-Fi module for example ESP-12e. To interface with the web and send parameters to the IOT stage we are using HTTP requests. To make alarms www.ubidots.com gives trigger event service.

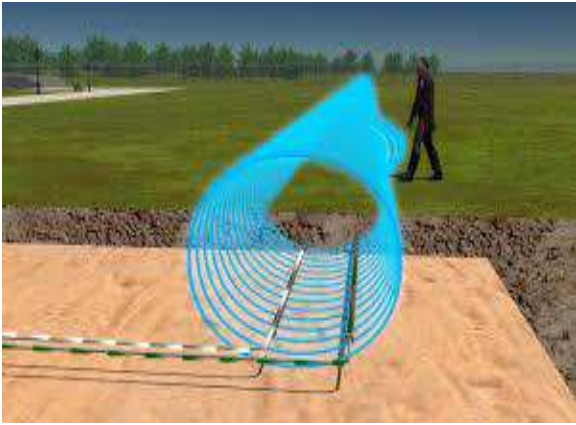


Fig. 4. System is using PIR sensors to detect human presence.

G. RFID

RFID [7], Radio Frequency Identification is a reasonable innovation, can be Radio Frequency Identification is a reasonable innovation, can be executed in a few applications, for example, security, resource tracking, individuals tracking and get to control applications. The main purpose of this paper is to structure and actualize a digital security system which can convey in a secured zone where just a genuine person can be entered. We executed a security system containing entryway locking system using passive kind of RFID which can enact, confirm, and approve the user and open the entryway continuously for secure access. The benefit of using passive RFID is that its capacities without a battery and passive labels are lighter and are more affordable than the active labels. A unified system deals with the controlling, exchange and activity task. The entryway securing system works ongoing as the entryway opens immediately when the user put their tag in contact with the reader. The system additionally makes a log containing registration of every user alongside fundamental data of the user.

H. Parking System

In the proposal, [8] the creator work with car parking system using Node MCU, IR sensor, LED. This system helps in arranging the parking slot and encourages the driver to achieve their parking spaces effectively as they realized which space is empty. The parking spot can be recognized using an Infrared sensor that interfaces with the ESP12-E (Node MCU) module that was programmed through the Arduino IDE. Users can get to parking spot data using a cell phone by means of an application. Particularly for users who have been enlisted previously, they have a code for login the application as the necessity for security system and user parking suitable [Fig. 5]. The system can work with the goal of research properly. In the system, the IR sensor is used for identifying the parking spot. The IR sensor is attached with the microcontroller Node MCU. Node MCU acts like a middle road between the sensors and the cloud. The Node MCU then transmits this information to the Firebase through Arduino IDE. The mobile application acts as an interface for the users to collaborate with the system on Cloud Firebase. This publication is helping us to work with IR sensor and Node MCU, firebase and the cloud server associated with the web it may be controlled remotely from anyplace on the world.

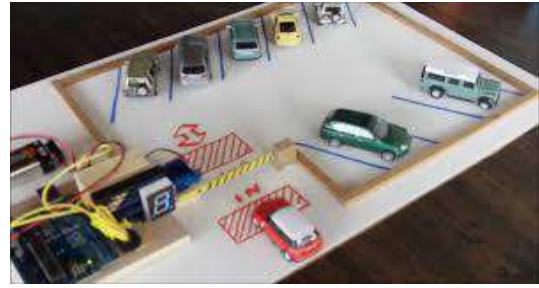


Fig. 5. Car entering the parking area and the display shows the number of vacancies in the parking slot.

This publication is related to the projects that can help us to work with IR sensor and Node MCU and applications that work with the cloud server.

These journals are related to our projects. It helped us to build the system and gave support to our theoretical knowledge so that we could work with IR sensor and Node MCU. Moreover, we tried to learn more about different apps that bridges between with cloud server and the Node MCU. These topics gave us an abstract idea that how actually a system can be implemented for border system, security purposes, using Infrared sensor in parking systems and ultrasonic sensors for distance calculation etc.

III. METHODOLOGY

A. Theorem 1

Here we have come through a plan diagram to get rid of the problem. Our basic idea is illustrated over the system flow diagram in Fig. 6. Here the diagram clearly states the flow of the system. Initially in the system the IR sensor detects the change and gives the signal to Node MCU. When the Node MCU receives the signal it sends to the BLYNK cloud and over there the data is processed and passed to the android app. From the app the notification is received and the buzzer and light is turned on.

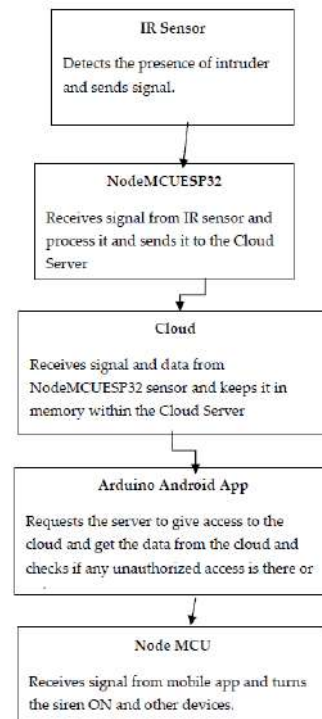


Fig. 6. System flow diagram.

B. Methodology Description and Its Functions

For building up the project of the system proposed, we are working with Node MCU esp32. Node MCU is an open source IoT stage. It includes firmware which keeps running on the ESP32 Wi-Fi SoC from Espressif Systems and equipment which depends on the ESP-12 module. Node MCU esp32 Wi-Fi module is working with an infrared sensor (IR). The location scope of the IR sensor is around 2 cm to 30 cm. The sensor module is interfaced with Arduino having IO voltage level of 3.3V to 5V. Most importantly, if an object detects by the IR sensor and after that the signal pass to the Node MCU esp8266 Wi-Fi module. Node M CU will check whether the Wi-Fi is connected or not. From that point forward, Node MCU esp8266 Wi-Fi module will check the signal from the IR sensor. And after that, the Node MCU esp8266 Wi-Fi module analysis the signal through Arduino IDE and send an HTTP request to the BLYNK cloud server. At the point when the user needs to see the touch history, then the web sends a request to the cloud server. Cloud server synchronizes the data from the database and response to the web server. At long last, the user can see details of the object which cross the IR sensor.

Let's say when an intruder arrives near the border and finds out that there is no soldier near the border or no security is there. He or she is trying to enter the border area illegally by taking the advantage of the current condition. The intruder steps in and blocks the signal transmission of the device. Then immediately alarm notification will be sent to the nearby army soldier. The soldier will be notified and will move towards the place where the intruder is. And can warn the intruder and take proper action that is needed to be done for breaking the law. Symbolic representation is shown in Fig. 7.

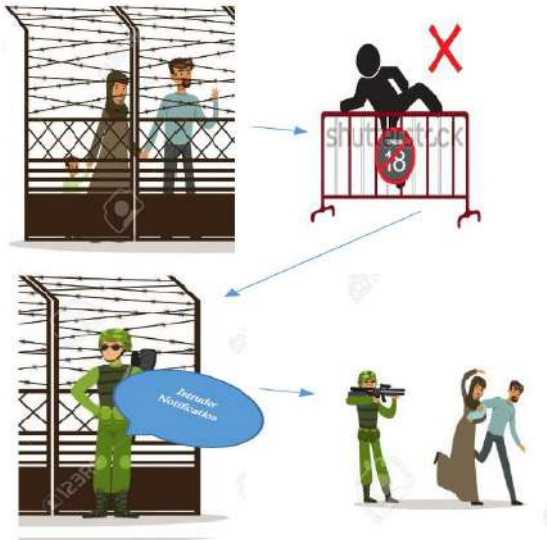


Fig. 7. Expected method of working during the intruder visit and steps to be taken.

A. Layout of the System

To make this project we use IR sensor, node MCU, BLYNK cloud server, Node MCU always connected to the server (cloud) by Wi-Fi service and have an ability to send the HTTP request to the server by giving a notification. This notification stores in the server database and server notice center update. When server update, then this update

notification sends to the user. User has an Arduino android app (Blynk app), and Web quickly observes this notification. Then from the app alarm is turned ON. Individual devices are shown in Fig. 8.

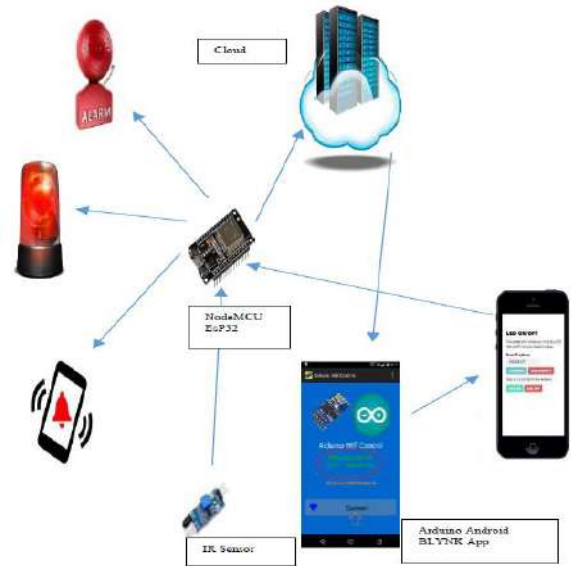


Fig. 8. Overall system function.

B. Discussion

We have implemented a simple basic circuit diagram to connect the system with the send signal via Wi-Fi. There are two following circuits. One of it connects D1 pin of the NodeMCU with the GND pin of the Buzzer and LED light represented in Fig. 9. And the other circuit shows how the infrared sensor is connected to the NoeMCU by connecting the wires with the source voltage of 3V, GND and analog pin (A0) [Fig. 10]. The basic diagram is given below:

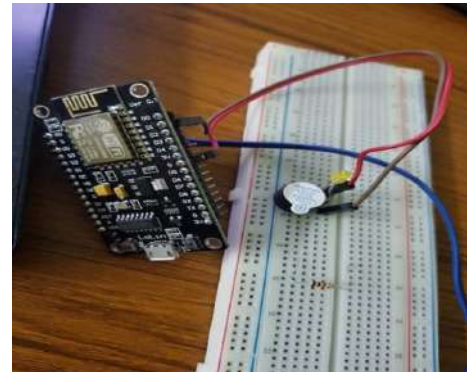


Fig. 9. Circuit connection, connecting the D1 pin with NodeMCU and the GND pin with buzzer and the LED light.

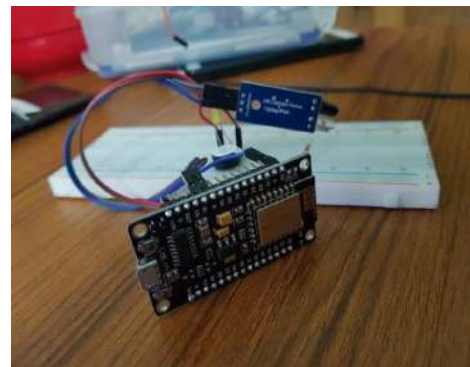


Fig. 10. Circuit of NodeMCU connecting the 3v, GND and A0 with the IR sensor.

When an intruder crosses the respective area, the signal is sent to Node MCU. It is directly sent via Wi-Fi to the Blynk cloud. It then sends a notification to the app (smartphone). See Fig. 11 the notification is taken from the app. Inside the app, we can see the notification message. And then we can go to the BLYNK app interface and from there we can turn ON the buzzer from the app. In Fig. 12 we can see the Buzzer is currently OFF. When the Buzzer is pressed it will turn ON the Buzzer. In the future, we will add a camera on this project and we will improve our detection area as well as we can use the ultrasonic sensor instead of the IR sensor. It can be used to detect a long-range object. For better and high-speed notification system we can use raspberry pi 3 B+ for make server request. Web and Android app user interface design can make more user-friendly and add more feature better user experience. We can use better and advance database system to add more data and space.

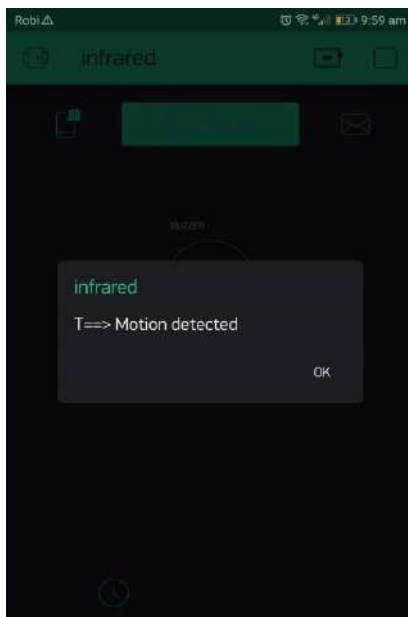


Fig. 11. Motion detected and the notification message pops up over the smartphone.

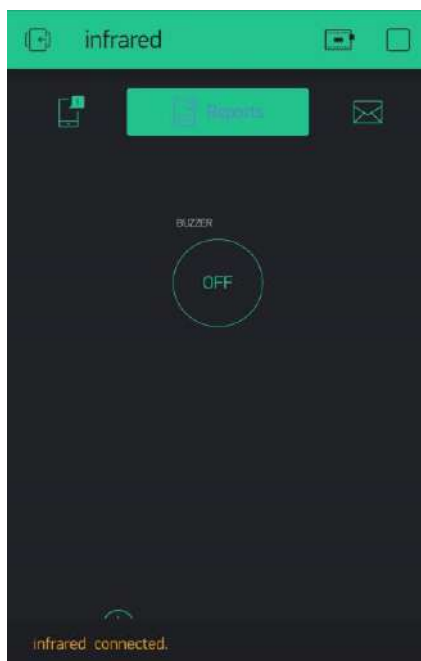


Fig. 12. Blynk app interface where the buzzer alarm is currently OFF. When it is turned ON the Buzzer and lights is turned ON.

IV. MATERIALS AND METHODS

A. Hardware Device

- Node MCU esp32:
- The Node MCU ESP-32S [9] is one of the advancement board made by Node MCU to assess the ESP-WROOM-32 module. It depends on the ESP32 microcontroller that flaunts Wi-Fi, Bluetooth, Ethernet, and Low Power bolster all in a solitary chip. Propelled API for equipment IO, which can significantly decrease the excess work for designing and controlling equipment. Code like Arduino, yet intelligently in content. Occasion driven API for system applications, which facilitates designers composing code running on a 5mm*5mm estimated MCU in Nodes style. Significantly accelerate your IOT application creating process. Under WI-FI MCU ESP8266 incorporated and easy to prototyping improvement pack. We give the best stage to IOT application advancement at the most minimal expense.
- BLYNK app
- Wire
- Breadboard
- IR Sensor
- An infrared sensor [10] is an electronic gadget with simple configuration, that radiates so that we can detect a few parts of the environment. An IR sensor can quantify the warmth of an item just as it recognizes the motion when an object is passed in front of it. These sorts of sensors emit infrared radiation and receive the radiation via the receiver that is called passive Infrared sensor.
- Buzzer
- LED

In our task, we are working with Node MCU esp32. Node MCU is an open source IoT stage. It incorporates firmware which keeps running on the ESP32 Wi-Fi SoC from Espressif Systems and equipment which depends on the ESP-12 module. [10] Node MCU esp32 Wi-Fi module is working with an infrared sensor (IR). The recognition scope of the IR sensor is nearly around 2 cm to 30 cm. The sensor module is interfaced with Arduino having IO voltage dimension of 3.3V to 5V.

The IR sensor has IR Transmitter that transmits the rays and IR receiver which receives the ray after getting any obstacle. It is shown in block diagram in Fig. 13.

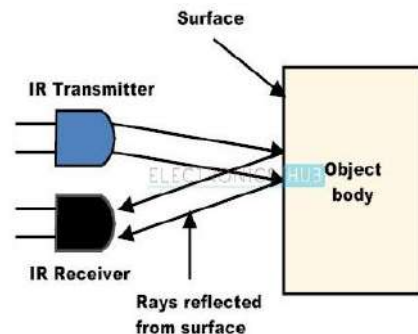


Fig. 13. IR transmitter and IR receiver sending and receiving rays. [10]

An IR sensor, **A** is mounted over a wall there is a gap between the human and the IR is distance **B**. The rays split

accordingly that when the human enters that range the rays will get the obstacle and get reflected earlier. It is represented in Fig. 14.

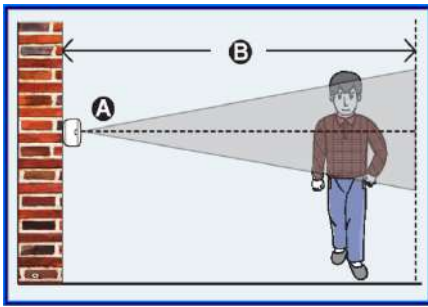


Fig. 14. Representing human intervention with diagram how IR transmitter and IR receiver works.

As a matter of first importance, if an item distinguishes by the IR sensor and after that, the flag goes to the Node MCU esp8266 Wi-Fi module to the web server from where the HTTP request is send to the NodeMCU. Node MCU will check whether the Wi-Fi is associated or not. From that point onward, Node MCU esp8266 Wi-Fi module will check the flag from the IR sensor. [11] And after that, the Node MCU esp8266 Wi-Fi module investigation the flag through Arduino IDE and send an HTTP (response) solicitation to the BLINK cloud server. This is shown in Fig. 15.

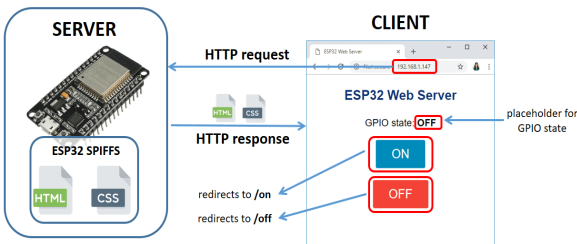


Fig. 15. [11] Determining how Http request is sent over internet to the BLYNK cloud and its app.

When a user needs to see the touch history, then the web sends a request to the cloud server. Cloud server synchronizes the data from the database as the data is categorized in NFS and CIFS and is stored in the google cloud. But our is stored int the Blynk cloud and response to the web server. [12] Finally, the user can see details of the time and date of the intrusion. This are handled in data centers. Represented in Fig. 16.

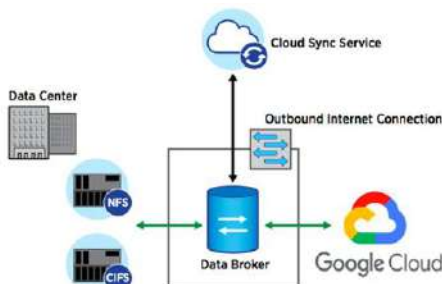


Fig. 16. Ref. [12] How data is stored in google cloud and synced.

Over this project we use IR sensor, Node MCU, BLYNK cloud server, Node MCU always connected to server by Wi-Fi service and have an ability to send http request to server

when a new Follower (Intruder) is found it goes to the database to check what message is written by the admin to give to the user. Using functions and algorithm it is forwarded to FCM and from the FCM (cloud) the message as notification goes to the user. This is shown in Fig. 17.

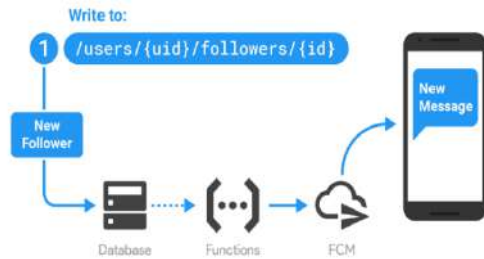


Fig. 17. New message is sent to the user when new follower arrives. And the path it follows to reach the user.

This notification stores in server database and server notice center update. [13] When server update, then this update notification sends to user. User have an Arduino android app, and web immediately see this notification. The notification is given by sending a particular message over the Blynk app. Which ensure the user about the intruder that entered the restricted area.

Initially, we included the libraries and used the authentication for the app then took the input from the user and the partial execution code of the whole system is being shown Fig. 18.

```

Node_MCU_with_Buzzer_and_LED | Arduino 1.8.7
File Edit Sketch Tools Help

Node_MCU_with_Buzzer_and_LED
1 #include <ESP8266WiFi.h>
2
3 #define BLYNK_PRINT Serial // Comment this out to
4 #include <BlynkSimpleEsp8266.h>
5 char auth[] = "374524ebf2ca430bacfd47e29e4156d";
6
7 /* WiFi credentials */
8 char ssid[] = "KL";
9 char pass[] = "abcd1234";
10
11 /* HC-SR501 Motion Detector */
12 #define ledPin D7
13 #define irPin A0 // Input for HC-S501
14 int irValue; // Place to store read PIR Value
15
16 void setup()
17 {
18   Serial.begin(115200);
19   delay(10);
20   Blynk.begin(auth, ssid, pass);
21   pinMode(ledPin, OUTPUT);
22   pinMode(irPin, INPUT);
23   digitalWrite(ledPin, LOW);
24 }
25
26 void loop()
27 {
28
29 }
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
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
1001
1002
1003
1004
1005
1006
1007
1008
1009
1010
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
1501
1502
1503
1504
1505
1506
1507
1508
1509
1510
1511
1512
1513
1514
1515
1516
1517
1518
1519
1520
1521
1522
1523
1524
1525
1526
1527
1528
1529
1530
1531
1532
1533
1534
1535
1536
1537
1538
1539
1540
1541
1542
1543
1544
1545
1546
1547
1548
1549
1550
1551
1552
1553
1554
1555
1556
1557
1558
1559
1560
1561
1562
1563
1564
1565
1566
1567
1568
1569
1570
1571
1572
1573
1574
1575
1576
1577
1578
1579
1580
1581
1582
1583
1584
1585
1586
1587
1588
1589
1590
1591
1592
1593
1594
1595
1596
1597
1598
1599
1600
1601
1602
1603
1604
1605
1606
1607
1608
1609
1610
1611
1612
1613
1614
1615
1616
1617
1618
1619
1620
1621
1622
1623
1624
1625
1626
1627
1628
1629
1630
1631
1632
1633
1634
1635
1636
1637
1638
1639
1640
1641
1642
1643
1644
1645
1646
1647
1648
1649
1650
1651
1652
1653
1654
1655
1656
1657
1658
1659
1660
1661
1662
1663
1664
1665
1666
1667
1668
1669
1670
1671
1672
1673
1674
1675
1676
1677
1678
1679
1680
1681
1682
1683
1684
1685
1686
1687
1688
1689
1690
1691
1692
1693
1694
1695
1696
1697
1698
1699
1700
1701
1702
1703
1704
1705
1706
1707
1708
1709
1710
1711
1712
1713
1714
1715
1716
1717
1718
1719
1720
1721
1722
1723
1724
1725
1726
1727
1728
1729
1730
1731
1732
1733
1734
1735
1736
1737
1738
1739
1740
1741
1742
1743
1744
1745
1746
1747
1748
1749
1750
1751
1752
1753
1754
1755
1756
1757
1758
1759
1760
1761
1762
1763
1764
1765
1766
1767
1768
1769
1770
1771
1772
1773
1774
1775
1776
1777
1778
1779
1780
1781
1782
1783
1784
1785
1786
1787
1788
1789
1790
1791
1792
1793
1794
1795
1796
1797
1798
1799
1800
1801
1802
1803
1804
1805
1806
1807
1808
1809
1810
1811
1812
1813
1814
1815
1816
1817
1818
1819
1820
1821
1822
1823
1824
1825
1826
1827
1828
1829
1830
1831
1832
1833
1834
1835
1836
1837
1838
1839
1840
1841
1842
1843
1844
1845
1846
1847
1848
1849
1850
1851
1852
1853
1854
1855
1856
1857
1858
1859
1860
1861
1862
1863
1864
1865
1866
1867
1868
1869
1870
1871
1872
1873
1874
1875
1876
1877
1878
1879
1880
1881
1882
1883
1884
1885
1886
1887
1888
1889
1890
1891
1892
1893
1894
1895
1896
1897
1898
1899
1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
1924
1925
1926
1927
1928
1929
1930
1931
1932
1933
1934
1935
1936
1937
1938
1939
1940
1941
1942
1943
1944
1945
1946
1947
1948
1949
1950
1951
1952
1953
1954
1955
1956
1957
1958
1959
1960
1961
1962
1963
1964
1965
1966
1967
1968
1969
1970
1971
1972
1973
1974
1975
1976
1977
1978
1979
1980
1981
1982
1983
1984
1985
1986
1987
1988
1989
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
2017
2018
2019
2020
2021
2022
2023
2024
2025
2026
2027
2028
2029
2030
2031
2032
2033
2034
2035
2036
2037
2038
2039
2040
2041
2042
2043
2044
2045
2046
2047
2048
2049
2050
2051
2052
2053
2054
2055
2056
2057
2058
2059
2060
2061
2062
2063
2064
2065
2066
2067
2068
2069
2070
2071
2072
2073
2074
2075
2076
2077
2078
2079
2080
2081
2082
2083
2084
2085
2086
2087
2088
2089
2090
2091
2092
2093
2094
2095
2096
2097
2098
2099
2100
2101
2102
2103
2104
2105
2106
2107
2108
2109
2110
2111
2112
2113
2114
2115
2116
2117
2118
2119
2120
2121
2122
2123
2124
2125
2126
2127
2128
2129
2130
2131
2132
2133
2134
2135
2136
2137
2138
2139
2140
2141
2142
2143
2144
2145
2146
2147
2148
2149
2150
2151
2152
2153
2154
2155
2156
2157
2158
2159
2160
2161
2162
2163
2164
2165
2166
2167
2168
2169
2170
2171
2172
2173
2174
2175
2176
2177
2178
2179
2180
2181
2182
2183
2184
2185
2186
2187
2188
2189
2190
2191
2192
2193
2194
2195
2196
2197
2198
2199
2200
2201
2202
2203
2204
2205
2206
2207
2208
2209
2210
2211
2212
2213
2214
2215
2216
2217
2218
2219
2220
2221
2222
2223
2224
2225
2226
2227
2228
2229
2230
2231
2232
2233
2234
2235
2236
2237
2238
2239
2240
2241
2242
2243
2244
2245
2246
2247
2248
2249
2250
2251
2252
2253
2254
2255
2256
2257
2258
2259
2260
2261
2262
2263
2264
2265
2266
2267
2268
2269
2270
2271
2272
2273
2274
2275
2276
2277
2278
2279
2280
2281
2282
2283
2284
2285
2286
2287
2288
2289
2290
2291
2292
2293
2294
2295
2296
2
```

```

Node_MCU_with_Buzzer_and_LED | Arduino 1.8.7
File Edit Sketch Tools Help
Node_MCU_with_Buzzer_and_LED
20 Blynk.begin(auth, ssid, pass);
21 pinMode(ledPin, OUTPUT);
22 pinMode(irPin, INPUT);
23 digitalWrite(ledPin, LOW);
24
25
26 void loop()
27 {
28   getIrValue();
29   Blynk.run();
30 }
31
32 .....
33 * Get PIR data
34 .....
35 void getIrValue(void)
36 {
37   irValue = analogRead(irPin);
38   if (irValue < 824)
39   {
40     Serial.println("=> Motion detected");
41     Blynk.notify("T=> Motion detected");
42     // led.print("Intruder in terminal 4");
43   }
44   digitalWrite(ledPin, irValue);
45 }
46
47
NodeMCU 1.0 (ESP-12E Module), 80 MHz, Flash, Disabled 4M (no SPIFFS) v2 Lower

```

Fig. 19. Execution code for the system (2).

The System is working properly after the execution of code and setting up the system properly using the LED, Buzzer and Node MCU.

Here, the device gives the notification of the intruder and the alarm is set ON, we can see it in the Fig. 20 below.

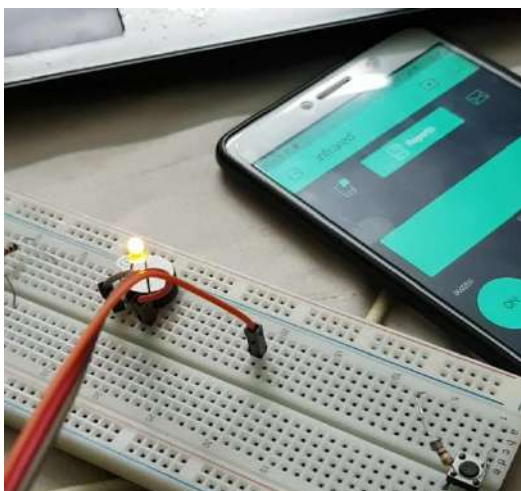


Fig. 20. Working of the project. When the switch is turned on from the Blynk.

V. CONCLUSION

We have seen how much hard work the army and the soldiers over the border do to keep their countries safe from terrorist attack and illegal people of other countries. It is really difficult to stay 24 hours fully active for the soldiers. To reduce their effort of the soldiers the system can be implemented and the security of the nation can be ensured. This system is really cost efficient and very easily usable for the soldiers.

CONFLICT OF INTEREST

Afsana Tasnim had an opinion of using Raspberry PI for the server connection. But the project would be expensive to use. So, Shawan Shurid decided to work it with Node MCU to reduce cost and make it easier. If we could use Raspberry PI, we would be able to get more features but the cost would increase 7 times more. Other than that, there was no conflict while doing the project.

AUTHOR CONTRIBUTIONS

Shawan Shurid and Afsana Tasnim together conducted the research and system specification. Shawan Shurid analyzed the system architecture and built the circuit and coded for establishing connection with server. Afsana Tasnim wrote the paper and managed the connection between the user application (BLYNK App). AKM Bahalul Haque was responsible for overall idea generation and supervision of the project. Reading, reviewing the project and working on it.

ACKNOWLEDGEMENT

We respect and thank our honorable faculty AKM Bahalul Haque, for providing us an opportunity to do the project work in detection of illegal border cross and giving us all support and guidance, which made us complete the project properly. We are extremely thankful to him for providing such a nice support and guidance, although he had busy schedule managing the corporate affairs. We were really great full and blessed to work under his guidance.

REFERENCES

- [1] S. Yasukawa and M. Kim, "Intruder detection using radio wave propagation characteristics," in *Proc. IEEE International Conference on Consumer Electronics - Asia*, Jeju, 2018, pp. 206-212.
- [2] R. NewlinShebiah, B. Deeksha, and S. Aparna, "Early warning system from the threat of wild animals using raspberry pi," *SSRG International Journal of Electronics and Communication Engineering*, March 2017.
- [3] V. Jyothsna and V. Prasad. (2019). Ijcaonline.org. [Online]. Available: <https://www.ijcaonline.org/volume28/number7/pxc3874730.pdf>
- [4] N. Bhuta, J. Joshi, and S. Chavan, "Intruder Detection and Run Time Response (IDRR)," in *Proc. International Conference on Smart City and Emerging Technology*, Mumbai, 2018, pp. 1-5.
- [5] N. Daxini, S. Sharma, and R. Patel, "Real time animal detection system using HAAR like feature," *International Journal of Innovative Research in Computer and Communication Engineering*, vol. 3, no. 6, June 2015.
- [6] S. J. Kamble, P. H. Marathe, and S. S. Rahatekar, "Human intrusion detection system based on IoT," *International Journal of Electronics, Electrical and Computational System*, vol. 7, no. 3 March 2018.
- [7] A. Nathan, A. S. S. Navaz, J. Jayashree, and J. Vijayashree, "Rfid based automated gate security system," *Journal of Engineering and Applied Sciences*, vol. 13, pp. 8901-8906, 2018.
- [8] L. Anjari and A. Budi, "The development of smart parking system based on NodeMCU 1.0 using the internet of things," *IOP Conference Series: Materials Science and Engineering*, vol. 384, p. 012033, 2018.
- [9] Last Minute Engineers. (2019). Insight into ESP32 features & using it with Arduino IDE (easy steps). [Online]. Available: <https://lastminuteengineers.com/esp32-arduino-ide-tutorial/>
- [10] Electronics Hub. (2019). IR (Infrared) obstacle detection sensor circuit. [Online]. Available: <https://www.electronicshub.org/ir-sensor/>
- [11] Wikihandbk.com. (2019). ESP32:Примеры/Создание веб-сервера на базе ESP32 при помощи файлов из файловой системы (SPIFFS) — Онлайн справочник. [Online]. Available: [http://wikihandbk.com/wiki/ESP32_\(SPIFFS\)](http://wikihandbk.com/wiki/ESP32_(SPIFFS))
- [12] A. Karim. (2019). Accelerate your application migration to google cloud platform with NetApp Cloud Sync. [Online]. Available:

<https://cloud.netapp.com/blog/accelerate-app-migration-to-gcp-with-netapp-cloud-sync>

- [13] Subscription.packtpub.com. (2019). {{metadataController.pageTitle}}. [Online]. Available: https://subscription.packtpub.com/book/hardware_and_creative/9781787288102/1/ch011v11sec15/connecting-the-esp8266-to-a-cloud-server

Copyright © 2020 by the authors. This is an open access article distributed under the Creative Commons Attribution License which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (CC BY 4.0).



Shawan Shurid is currently a student of North South University studying computer science engineering where he is going to complete his under graduation by 2020. His majors are computer networking, computer security, web developer (word press, PHP developer). He also has expert knowledge on C, C++ , Java, Python and Assembly Language. Partially he works with IOT devices for social security and other purposes.



Afsana Tasnim is currently a final year student of North South University pursuing BS in computer science engineering and will be graduating in 2020. She is an ardent programmer in software engineering and programming languages like C, C++, Java and net technologies. She has a strong interest in the field of computer security and information assurance. Her research interest includes areas of computer security, operating systems and mobile security.



AKM Bahalul Haque is currently working as a faculty member of Department of Electrical and Computer Engineering in North South University. He completed his bachelor in computer science from Bangladesh and his master of science in information technology from Germany. His area of research is cyber security and software engineering. He has research papers published in International Journal and Prestigious conferences.