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Mobile Guidance System for Evacuation based on Wi-Fi System and Node Architecture

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Abstract

Recently great loss of life and property is occurring because of fire, natural disaster, earth quake, tsunami and so on. People spend 80~90% of their time indoor environment like office, supermarket, campus. Therefore Indoor navigation and guidelines system became so essential for most of all. Incase of emergency we must be careful earlier, in such a cases 5G kind of new technology may also cannot work. So immediate action and quick routing notification for guidelines and protection is the most. Considering this issue We proposed indoor evacuating guidance system based on microcontroller Wi-Fi board for Indoor APP using mobile. Focusing various kind of technology like, ok google, voice search APP we purposed node architecture based system. When we listen fire alarm while living inside the room. Then to be safe we connect with server and start Arduino UNO + IoT ESP8266 Wi-Fi shield version1-IoT module to store data in MySQL DB server. We make application to escape out from the building up-to the three exits giving information from source point to destination. Our program can send information to the users emergency location and situations. For this when the user get sound or vibration in their mobile device it indicate fire out near by. At that time we update message from Arduino to DB server for the fixed current position inside the building which give routing signal for that fire out location by changing values from 0 to 1. We have user in point 10 where user is near by. Later we detect Wi-Fi signal form Nodemcu as room of each floor and try to connect with user. Main purpose of this paper is to save life of people in short time and find out the shortest path up to nearest exits in the time of emergencies and rescue them.

Keywords : IPS, ESP8266 Wi-Fi Module, Node Mcu, MySQL DB server, APP

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1. Introduction

Life, property are greatly lost due to fire, natural disasters, earthquakes. People use 80~90% of indoor environments, such as apartments, supermarkets, campuses. Indoor evacuation guidance info is important. Early precaution must be taken to evacuate from emergencies. We research applicable technologies for evacuating fire incase of buildings. They are Trilateration, Location recognition, Fingerprint. among them we proposed, Wi-Fi system based node architecture for indoor Positioning. There are fire sensors (nodes) in each room. When fire occurred user heard the broadcast, check the location of the Wi-Fi signal to find out fire out place to be safe from danger. Wi-Fi Access Points (APs) were identified by arduino sketch Software Programming+Arduino ESP8266 Wi-Fi shield version1-IoT module checks Wi-Fi signal and location for guidance. This module checks Wi-Fi signals and determine performance, quality and time of the node for indoor location. We store data in DB server matching them and update using quary statement. Informs the place of fire from server and focus user location by Wi-Fi signal [Jeong et al., 2012]. We provide routing information, arrow route to evacuate from a dangerous place to a safe place mobile. User guide by a shortest path with an arrow to evacuate to Exit 1, Exit 2 & Exit 3 of the building. After detect the place of fire, it calculate the TimeCost by algorithm using Shortest Path Routing from current user position to Destination. All data is monitored by the control server in the building. We have fixed 110 node in the building. In which fire out place change value from 0 to 1 remotely. We get Wi-Fi Information, AP using embedded sensor and arduino code. This algorithm provide routing path to the user with route. Main proposed of this paper is to save people's life in a short time and to guide them to the best shortest route upto the nearest exit. It is our research goal and proposed monitoring system to protect from fire, targeting other huge skyscrapers around the world. It is the subject of future research on Indoor Positioning System (IPS) and Indoor Navigation System (INS) [Timalsina et al., 2018] based on node architecture.

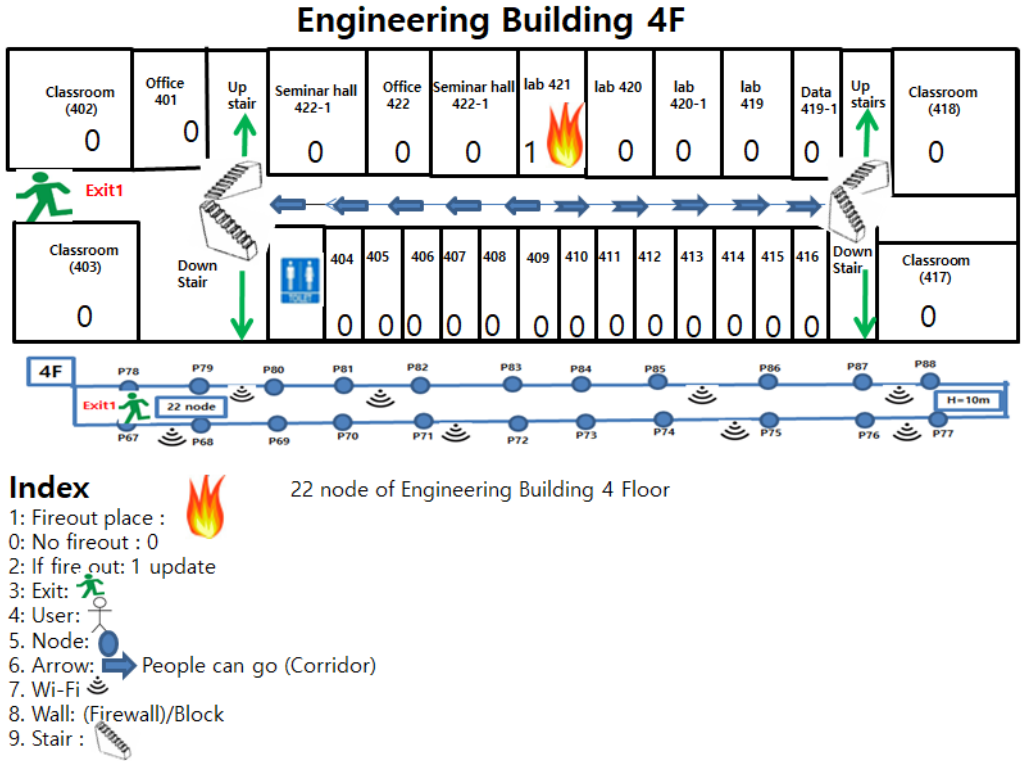
2. Indoor Fire Location

2.1 Research Status

To overcome the points mentioned in our previous paper, we mainly focus five additional methods in this paper they are as follows [Jeong et al., 2012; Timalsina et al., 2018]. ① Combination by hardware and software. Add fire out place to source code. Direction matrix algorithm using visual studio 2017 for shortest path, TimeCost calculation and arrow guidance Save Signal Strength (AP) data in MySQL DB server ⑤ Use embedded system, IoT devices like ESP8266 Wi-Fi module, NodeMcu, Breadboard connection with Jumper cables. Moreover we use fixed user (Start Position = P10) and (Destination = Three Exits) of the building in our experiments. These are our proposed idea based of Wi-Fi and Node architecture for the building.

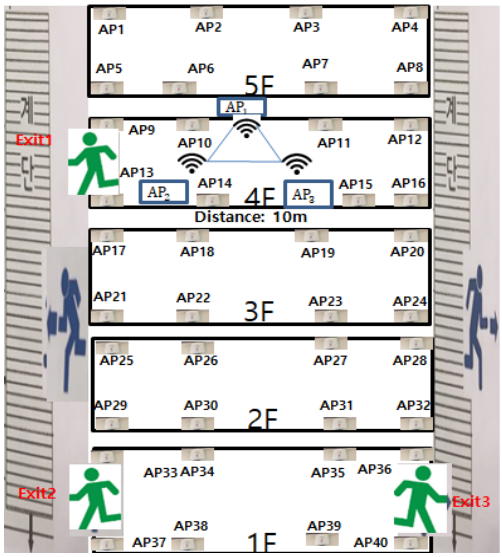
2.2 Fire Location Detection

When fire out inside the building. User heard broadcast from each floor, through fire



〈Figure 1〉 Wi-Fi Information Attached Near Indoor Position

sensor. 〈Figure 1〉 User want to escape out from fire out place, try to evacuate safely to the exit. User worried to evacuate, and to find the nearest exit. To find exit and safety place user try to detect current position by the Wi-Fi signal from the Arduino ESP8266 Wi-Fi shield version 1-IoT module. Save data to the DB server. User search Wi-Fi signals, Wi-Fi Access Points (APs) of the corridor near the fire out place, verify the signal strength of the surroundings and then set up a route to the exit closest to the server. Server displays route of the building from current location to the destination of the fire with the building information using direction matrix. In matrix method, movement path is defined as a two-dimensional array of integers for x, y axis, route path to move from current position to east, west, north south, and both stairs upto nearest exits. This building have total 3 exits, 1 exit in 4^{th} floor two exit in 1^{st} floor. All Information is in main administration DB server. Location of the fire (421 Wi-Fi: uitlab) is detected by server, applying direction matrix-based evacuation route to avoid place of fire. algorithm calculate exit 1, of 4^{th} floor is fire place so people cannot go to this exit 1 side because of biggest TimeCost. Second calculate user path E → E → S → S → S → (Exit 3) which is best shortest path 1 route upto exit. In this case user fixed location for the start point, and destination. Third user get E → E → S → S → S → W → W → W → W → W → (Exit 2) 2 route. Finally shortest evacuation route is supported in the direction through the APP and guided using arrow, to evacuate from fire out place to the nearest exit [Lee et al., 2019].

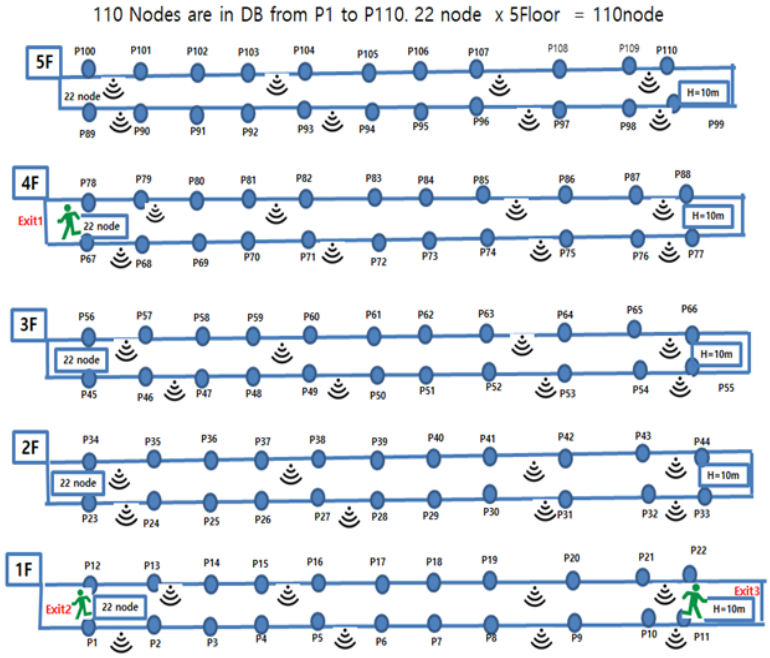


〈Figure 2〉 Wi-Fi Information Attached Near Indoor Position

2.3 User Location Detection

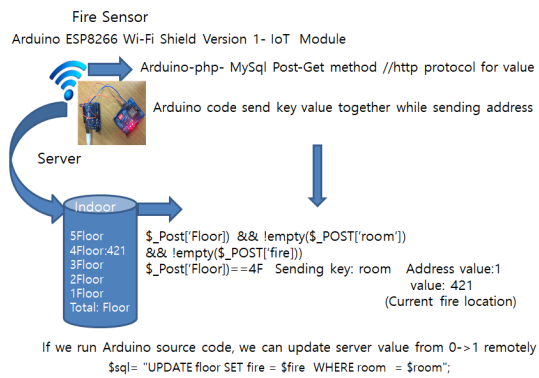
〈Figure 2〉 shows three exits of the building, first exit is in fourth floor and the other two exits are on the first floor. Each floor has a height of 10m and a corridor hallway of 50m. Shortest path to exit 1, exit 2, and exit 3 are stored in the DB server after calculating from algorithm. As shown in 〈Figure 2〉. 8 Wi-Fi APs exist in each corridor. Therefore, in case of emergency shortest route from the starting point to the destination will be guided. Indoor navigation of modern skyscrapers and large buildings is essential. In this building there are 22 room in each floor. Routing from source point and destination will get using fixed sensor nodes of the ceiling of each room. Wi-Fi signal and data in DB server are updated by SQL query statement and experiment with fire location from 0 to 1.Guide the escape route to the nearest exit from the place where the user is in point P10 as like in fig 12. Method proposed in this paper for escaping to the exit is the direction matrix, which tracks the fire in real time using Wi-Fi signals and guides the escape route using a direction matrix based algorithm [Poston et al., 2016]. Similarly we have made 1 floor, 2 floor, 3 floor, 4 floor and 5 floor in the node base architecture to find out user location. For this purpose indoor navigation according to node view is show in the below 〈Figure 3〉. This is design is specially for the network purpose to connect user location and the Wi-Fi. The main axes of the network are defined by room based of the building. Each room of the point are considered as a node for the system, which can track user location near by Wi-Fi signal in 3D dimensions. It illustrate the indoor 110 nodes from p1 to p110 from 1F,2F,3F,4F,5F [Jeong et al., 2012; Timalsina et al., 2018]. We consider 421 of 4^{th} floor is a fireout place as like in 〈Figure 1〉. This 22 nodes of each floor can be 22×5 = 110 rooms in total starting from 1st floor to 5th floor. There are 8 Wi-Fi APs in each floor which are 40 in total as like in 〈Figure 2〉 which means 8×5 = 40 APs in total since it is of 5^{th} floor building. Reference 1 use full duplex evacuation information system concent and FRIIS methods but we use IoT module and node based concept [Jeong et al., 2012; Lee et al., 2019; Nair and Supriya, 2018]. we use NodeMcu to find out Wi-Fi signals more specifically for user location and detect strong signal strength for network purpose. Reference paper 1 use Wi-Fi signal as and show shortest path route from user position to the upto exit from the mobile [Jeong et al., 2012].

〈Figure 3〉 shows node based building architecture inside represented by P110 nodes of 5 each floors respectively. These are room based nodes of the building represented from p1 to P110 of the indoor. There are 22 rooms each room are filled by nodes. This node can search after detecting Wi-Fi informations of the building from Wi-Fi locations and the



〈Figure 3〉 Building Inside Structures Represented by 110 Nodes of 4th floor

signal strength. This building is from 1 floor to 5 floor. Each floor have 22 rooms, two bathrooms and ladder on both sides. We use this 22 rooms as a node for the network and location purpose. After this we can search user location using Track me. User are in random based in different place but we do not no the exact place. Therefore to detect exact location of the user, nodes will help. All this nodes have number in each for every floor We use arduino programming and use that in php to connect MySQL DB server using post-get method to connect values for the http protocol, in this case arduino code send key values together while sending fire out place with address. As $_Post[Floor])&&!empty ($_Post ['room']) &&!empty($_Post['fire'])). $_Post['floor])==4F sending key values_room, address values: 1 where value:421(Current fire location). Server can update value from 0 → 1 remotely as $sql ="update floor SET fire = $fire where room = $room"; it shows fire sensors of the building.

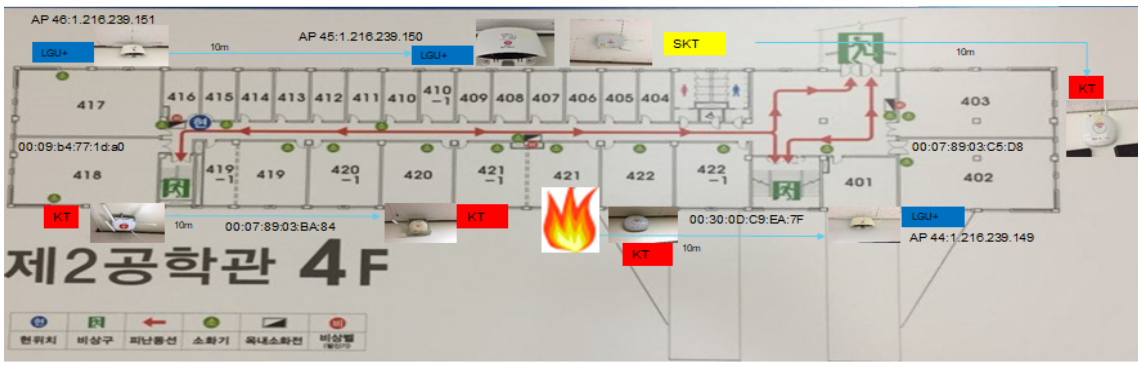


〈Figure 4〉 Building Inside Structures Represented by 110 Nodes of 4th Floor

We use arduino esp8266 Wi-Fi shield version 1-IoT module for the sensor. Our system detect fireout place looking strong signals of Wi-Fi. There are 8 Wi- Fi machines attached above the ceiling of the corridor [Poston et al., 2016]. We use Building inside structure represent by 110 nodes of 4th floor. Which insert fire out location in database. DB server on each floor 〈Figure 4〉, explains fire detec-

tion using Arduino ESP8266 Wi-Fi Shield Version 1-IoT module checks Wi-Fi signal and location for guidance. Server update fireout place for the user. When it monitor and update values continuously from the server. Fire out place is changed 0 to 1 so the user knows that the fire ut place is 1 which is fireout-sensitive and dangerous location. This is the fire localization system we purposed. 〈Figure 5〉 below shows Wi-Fi information and interior location map of the corridor. This picture is of 4th floor Engineering Building Ⅱ. There are eight Wi-Fi machines attached from 402 to 422 in the building. In order to know the fire out place we use IoT sensors [Nair and Supriya, 2018; Seo and Jang, 2017]. Direction to go to the exit is user → 10 → 11 → 12 → 18 → 24 → 30 → escape TimeCost (185) Exit 3 is the best shortest path from this floor. This sensors are IoT sensors for the network purpose. Arduino sensors can scan Wi-Fi networks. To use arduino we use Application Programming Interface (API) API almost the same with W-iFi shield library. While writing source code for the library it is set Wi-Fi to station node & disconnect from an AP if it was previously connected. In the figure arrow is showing from the middle track from which user can go left and right side. There are two ladders near 402 to 403 side at the right and 417 to 418 at the left side. 8 Wi-Fi machines from different telecom are installed among them. Which can be seen a s blue colors are of LGU+, four red colors are from KT and one yellow color from SKT. After detecting from arduino esp 8266 module we found fire out place is 421 because we found strong signal strength can be seen as like in 〈Figure 6〉 and fire sign is seen clearly. This place is of 4th floor as shown in the above picture. Therefore if user is near by the fire-out place then it is easy to know shortest path direction arrow guidance to go to exit from 421. In this case user can use this route like user-p10-p11-p12-p18-p24-p30-exit 3 escape. Its TimeCost is (185) which is select as the best shortest path.

〈Figure 5〉 shows Wi-Fi information and interior location map of the 4th floor corridor. This picture is of 4th floor of engineering building Ⅱ. There are altogether 8 Wi-Fi machines attached from right side 402 to left corner 422 above the ceiling. Considering various ideas and application incase of building emergency we use sensors to get Wi-Fi information. From which signals and distance can be know. with Wi-Fi machines for navigation and evacuation purpose in case of emergency and fireout conditions. Which can be same as 4th floor incase of fireout in other floors. Wi-Fi information which from.

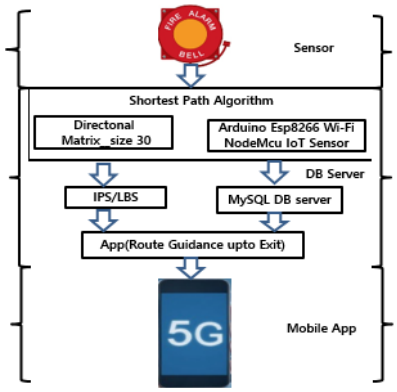


〈Figure 5〉 Wi-Fi information and Indoor loHcation Map of 4th Floor of the Corridor

```
scan start
scan done
24 networks found
1: ollehWiFi  (-86)
2: T wifi zone (-90)
3: T wifi zone_secure (-88)*
4: T Free WiFi Zone (-88)
5: mclab (-82)*
6: KT_Free_WiFi (-86)
7: U+zone (-73)*
8: FREE_U+zone (-68)
9: ckdisplay1 (-91)*
10: U+zone (-95)*
11: FREE_U+zone (-92)
12: ollehWiFi (-84)
13: yc214 (-85)*
14: uitlab (-57)
15: kdelab (-69)*
16: DBlab (-92)*
17: iptime(421-1) (-70)*
18: U+ Zone (-86)*
19: U+ Zone (-76)*
20: U+zone (-83)*
21: U+zone (-77)*
22: T wifi zone (-83)
23: T wifi zone_secure (-83)*
24: FREE_U+zone (-77)
```

〈Figure 6〉 Wi-Fi Information Extracted through NodeMcu

〈Figure 6〉 It is not easy to detect user indoor location inside the building like GPS. We use NodeMcu and IoT ESP8266 module to check Wi-Fi signal and location separately. Detect fire out location near uitlab in which signal strength is strong among Wi-Fi. It's signal strength is (-57) means it's strong. P erformance of purposed idea use hardware configuration and software program in our system. 421 uitlab(-57) Wi-Fi signal strength is measured in dBm (decibel milliwatts) and is somehow confusing because it express only as negative value. This Signal Strength is strong and reliable signal strength .We apply Wi-Fi scan to measure RSSI (Received Signal Strength Indicator). When we detect signal of the Wi-Fi then it is more easy to find out the physical location from which it is easy to use frequency range from fire out place to user current location. Even though there is no way to know 100% signal inside the building. But we apply nodebase to track user. This is another different point from reference [Jeong et al., 2012].



〈Figure 7〉 Fire Detection and Evacuation Guidance System

〈Figure 7〉 is the fire detection and evacuation guidance system proposed in this paper. Therefore it is possibile to detect user of the 4^{th} floor from fire out location where the signal is the strong. For this we purpose node base system, in which all the rooms are considered as node. We are researching various ways to find out track me from the android based environment. Fingerprinting, Trilateration, for indoor user tracking based on Wi-Fi and so on others. After this step user go to the destination exit for escape using the shortest path. We calculate dijkstra algorithm based shortest path and best routes from fire out place to safety place to escape upto exit 1, exit 2 and exit 3 [Poston et al., 2018; Alamri, 2018].

3. Fire Detection and Evacuation Guidance

We use Arduino ESP8266 Wi-Fi sensor to which detect fire signals after receiving fire out broadcasting sound from the above first layer. This is fire sensor it is in every room and corridor of the building. After receiving sound an we detect singles from arduino ESP 8266 Wi-Fi and store data in the MySQL DB server. Later we implement guidance route path upto exit according to the TimeCost.

```
mysql> select * from fourthfloor;
+-------------------+-----+------+----------+-----------------+-------------------------+
| IPandMacAddress   | AP  | SSID | Location | Distanceuptoexit | Distancefrom421toeachWiFi |
+-------------------+-----+------+----------+-----------------+-------------------------+
| 1.216.239.151     |  46 | LGU+ | 417      |              60 |                      14 |
| 00:09:b4:77:1d:a0 |  47 | KT   | 418      |              55 |                      12 |
| 1.216.239.150     |  45 | LGU+ | 408      |              35 |                       4 |
| 00:07:89:03:BA:84 |  48 | KT   | 420      |              40 |                       6 |
| e3:c7:04:16:3f:13 |  10 | SKT  | 406      |              30 |                       5 |
| 00:30:0D:C9:EA:7F |  50 | KT   | 422      |              50 |                       7 |
| 1.216.239.149     |  44 | LGU+ | 401      |              10 |                       8 |
| 00:07:89:03:C5:D8 | 137 | KT   | 402      |               5 |                      10 |
+-------------------+-----+------+----------+-----------------+-------------------------+
8 rows in set (0.80 sec)
```

〈Figure 8〉 4th Floor Wi-Fi Information, Shortest Distance Routing to Nearest Exit

〈Figure 8〉 shows the 4th Floor Wi-Fi Information, shortest distance routing to nearest exit. When we find out the location of the fire we keep this as a direction Matrix of size 30 in our algorithm. Save IP, Mac Address, AP, SSID, location, Distance to exit, Distance from 421 to each Wi-Fi in DB server. And try to make IPS and Location Based System (LBS), IPS is a network of devices used to locate people or object where GPS and other satellite technologies are week or fail entirely. There are various ways and technologies for indoor positioning systems. Therefore due to the increasing of huge and tall buildings, airports, alleys, parking garage, supermarket and many more. We focus mobile based guidance system on case of emergency situations using Wi-Fi. For this case we use Arduino ESP8266 module and nodemcu to checks the signal of Wi-Fi, match them into MySQL DB server. Finally we connect with App and showing from android mobile. Further we are focusing to find our user indoor location showing indoor route guidance upto exit of this building. 〈Figure 8〉 shows Wi-Fi information, shortest distance routing to nearest exit on the fourth floor in an indoor building. Each floor has 8 Wi-Fi×5 Floor = 40 (8×5 = 40) from AP1 to AP40. DB server has IP and Mac-address, AP, SSID, Location, Distance up to exit Distance from 421 to each Wi-Fi, floor, room number. This is the exact 4th floor and current location of the fire out place and user.

```
mysql> select * from  floor;
+-----+-------+------+------+------+------+
| num | floor | room | rssi | ssid | fire |
+-----+-------+------+------+------+------+
|  103 |  4 |  419 |  23 |  1 |  0 |
|  104 |  4 |  420 |  24 |  1 |  0 |
|  105 |  4 |  421 |  25 |  1 |  0 |
|  103 |  4 |  419 |  23 |  1 |  0 |
|  104 |  4 |  420 |  24 |  1 |  0 |
|  105 |  4 |  421 |  25 |  1 |  1 |
```

〈Figure 9〉 Fire Position Converted from 0 to 1 in DB

〈Figure 9〉 shows the process of automatically updating fire out place from 0 to 1 user (P10) to provide network information and routing for area near fire out [Jeong et al., 2012; Nair and Supriya, 2018]. There are total value of P110 nodes in the building structure in the floor table in the DB server. 110 nodes are stored in 5 Floor, 4 Floor, 3 Floor, 2 Floor, 1Floor (22×5=110) DB. These nodes are rooms on each floor. Each room has six columns: num, floor, room, rssi, ssid and fire.

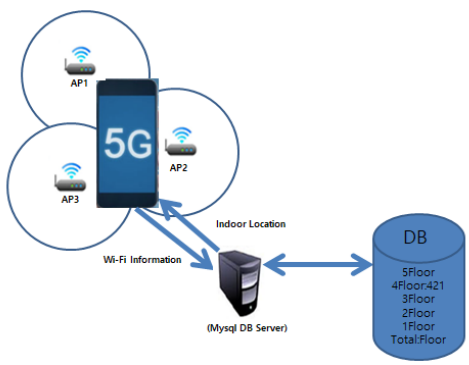
3.1 Fire Location Detection and Database Server Implementation

In order to implement the IPS guidance system We monitor all things with the control server of the building and transfer important data to the database server after detecting the fire location. location is changed from 0 to 1 automatically by post-get method using PHP & MySQL. Routing information is passed from the server to the app. Data of the server can be updated in real time, it can check the indoor environment and prepare

the location, to store. We use MySQL 5.7 DB server for our experiment. Use App on the smartphone, and apply android phone to view the exit and all arrows routing information. First, all the data are set to 0, when fire out MySQL changed from 0 to 1 by applying a query statement to the fire space. $ sql = "update floor set fire = $ fire WHERE room = $ room"; Run the Arduino program and apply the update DB server data of the indoor 421. The data from p1 to p110 were made through Routing .There are a total of P110 nodes in the building to make the evacuation path visible [Xia et al., 2017]. in the Floor table in the DB server. As shown in the figure, 110 nodes are stored in 5 Floor, 4 Floor, 3 Floor, 2 Floor, 1 Floor (22×5 = 110) DB. These nodes are rooms on each floor. Each room has six columns: num, floor, room, rssi, ssid and fire. First, all the data in fire are set to 0, and then the MySQL value selected automatically is changed from 0 to 1 by applying a query statement to the fire space. $ sql = "update floor set fire = $ fire WHERE room = $ room"; Run the Arduino program and apply the update DB server data of the indoor 421. The data from p1 to p110 were made through Routing Algorithm through character direction matrix data App to make the evacuation path visible [Seo and Jang, 2017].

3.2 Wi-Fi Access Point(AP) Detection to Find Detailed Location

3 Wi-Fi AP1, AP2, AP3 near the fire on the 4th floor, with MacAddress, AP, SSID, location 408,406 & 420. Here exit 1 is close to No. 421. After finding the location of the fire, Location of user must be detect using node [Xia et al., 2017]. Therefore, after DB Matching, which are the closest among the eight, There is users near by, and each floor case and data are different. Our system identify fireout location more specifically from the 3 near out place which is in center. From this place user of P10 can escape upto nearby exit looking Distance upto exit using footpath 30, 35, 40 and Distance from 421 to each Wi-Fi 4m, 5m, 6m from t. This is the extra point from reference 1 and other papers in our system. 3 Wi-Fi are centered fire out location where there is user near by in the same floor. 5G mobile connected with Wi- Fi information inside which match with MySQl DB server near this area inside room of 4th floor. This is important to detect user from fire out place to user and distance from 421 to each Wi-Fi. Reference 1 use propagation area formed the AP in 5 different methods but we use 8 AP of the corridor and select 3 near the fire out place for Trilateration method based [Jeong et al., 2012; Alamri, 2018]. 3 APs from the 8 Wi-Fi that are on the 4th floor.



〈Figure 10〉 Wi-Fi AP1, AP2, AP3 for Evacuation Information

〈Figure 10〉 We extract the nearest AP 1, AP 2 & AP 3 from 8. Center part is the fire out place among 3APs where user is near here in the same floor. We can find out the exact information such as the distance from the fire to the exit, Wi-Fi information, Location, AP, etc. Therefore after DB matching,

〈Table 1〉 Results of Shortest Distance Calculations from Algorithm

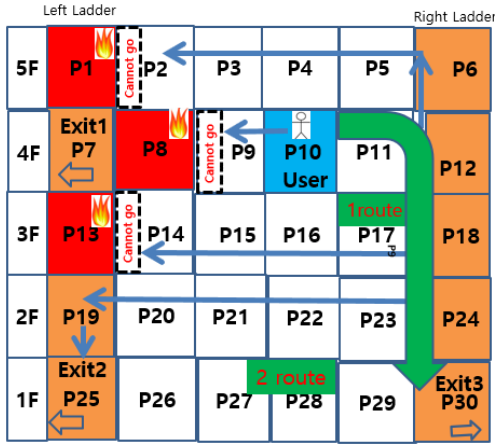
No.	TimeCost	Direction Arrows
1. 10 → 9 → 8 → 7 → Exit 1 escape	〈105〉Minimum TimeCost	User → W → W → W → Exit 1
10 is start position of the user	Among 8 route	User start from 10
Input values: 1, 8, 13	Fire out place	4^{th} Floor near Exit 1
2. 10 → 9 → 8 → 7 → Exit 1 escape	〈570〉Maximum TimeCost Cannot go	User → W → W → W → Exit 1
3. 10 → 11 → 12 → 18 → 24 → 30 → Exit 3 escape	〈185〉TimeCost (Best Shortest Path)	User → E → E → S → S → S → Exit 3 1^{st} Route
4. 10 → 11 → 12 → 18 → 24 → 23 → p22 → p21 → p20 → p19 → p25(Exit 2) escape	〈385〉TimeCost (2^{nd} Best Shortest Path)	User → E → E → S → S → S → W → W → W → W → W → (Exit 2) 2^{nd} Route

This method have drawback so we use node based idea to find user location. Each room are considered as a node which is in Indoor map. 〈Table 1〉 shows results of distance calculation using shortest path algorithm from that it is easy to detect room, after that there will be Wi-Fi which can show the strong signal near the user. Wi-Fi network and connection of Access Points(AP) has been rapidly rising in the tall and new modern buildings. Hotspots are ubiquitous in the urban areas. Basic idea to calculate distance using trilateration where three circles are overlap also have defects [Xia et al., 2017]. Even if we draw three circles in the google map and make test for the location it may have intersect problems. Even though if we try to calculate distance to a Wi-Fi from RSSI using Wi-Fi routers. They are also not exact way to find out user location. Location service from Trilateration is also not exact. Therefore we purpose NodeMcu to measure exact position of the fireout finding there powerful signals and Wi-Fi location. from this experiment we purposed that node architecture based idea for the user location for the indoor positioning to detect user. It is specially to identify the fire, extract fire our location of the indoor environment. We use MySQL DB query statement specially for the three IP and MacAddress, AP SSID, Location, Distance up to exit, Distance from 421 to each Wi-Fi for Trilateration purpose. From this method fire position incase of indoor location of the building because somehow possible but not user location [Mun et al., 2016]. So we start node based Path tracking idea to detect Wi-Fi signals using node.

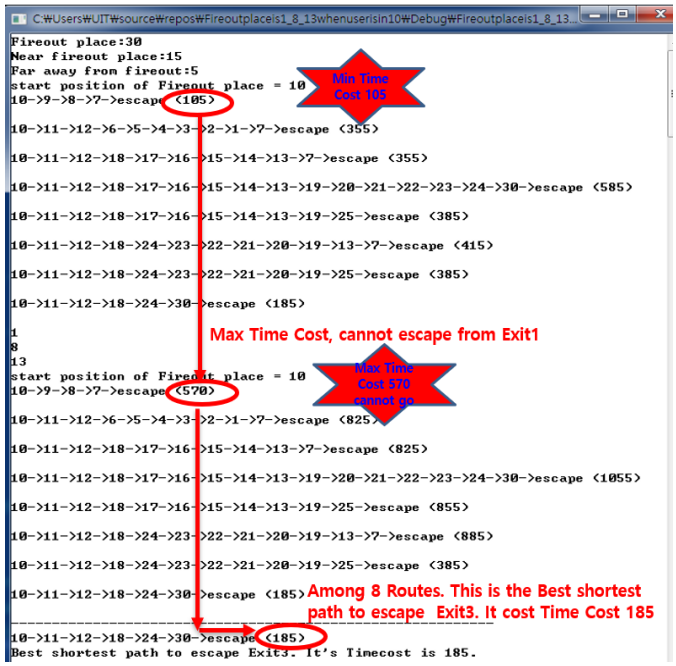
3.3 Shortest Path Algorithm Using Direction Matrix

Directional Matrix use to compute a series of objects with numbers or variables according to Rows and Columns. Like a GPS navigation, user decide to go to a route by using an arrow from the current position (Start Position) to the (Destination). Here data must be arranged in an array in matrix base so that it can calculate each row and column element. In our system matrices, declare #define MATRIX_SIZE 30,user pos_start = 0 from the current position to pos_end, which computes outputting result from the algorithm. Direction matrix plays an important role in implementing the arrow guidance system. This requires 4 types of data.

1. User Position (P10) - 4th Floor
2. Destination location to be moved to
3. Direction of east, west, north and south,
4. The direction in which the user is looking forward when standing.[Jeong et al., 2012] paper have FRIIS formulas for Distance measurement. But we have calculate TimeCost, Direction Arrows up to Exit 1, Exit 2 and Exit 3 [Jeong et al., 2012; Gao and Zhao, 2017]. Data in the direction matrix is used to guide the shortest routes. It use random method to access data user who is in current position can see the direction path to go to the destination exits. Proposed direction matrix is important for evacuation systems in emergency situations because it can shows the paths according to the direction map with east, west, north south direction. This leads to the opposite direction of fire out place showing an exit arrow to the nearest exit and an infinity value to avoid the fire in the source code for the evacuation route. Result of the experiment from the algorithm is shortest route path as follows (see <Table 1>). It has location of the fire where 1, 8, 13 is entered the value of TimeCost (570) is large. To avoid this large values user use other place and make a route to nearest exit. From no 3 of above <Table 1>, user place 10 → 11 → 12 → 18 → 24 → 30 → Exit 3 escape out. User see route upto the exit while looking at the arrow visible on the smartphone APP. This is the best shortest path route to the user upto nearest exit. It is specially for moving towards the target safe area. Direction matrix find way according to the arrows. User can escape from the exit by using both directions and stairs in an emergency. Data are clear for the direction to East (E), West (W), North (N), South (S) up, and down stairs, <Figure 11> shows building structure from 1 floor to 5 floor. We detect current user location (P10). This is a fire escape route towards the exit. User near fire started with one node heading toward the exit and searched for adjacent nodes to find the way to the destination using direction matrix. It is define as an array of 30×30 which can found an evacuation route exit [Choi et al., 2015]. This is the best shortest path between two points. Every floor is of 6 plot. When evacuating from fire out place to the safety zone it is necessary to contact 119 or police immediately. We use Node based method for user location finding method [Shin and Kim, 2017]. Arrange each node in the according to room. After finding Wi-Fi signal we made 5F×6plot = 30. Use 30×30 array <Figure 12> explains routing to the exit after the fire confirmed. It is based on shortest path algorithm to calculate TimeCost. Where P1, P8, P13 are the fire locations. P10 is the user current location. We give infinite value to the location where the fire occurred, calculate the value Use direction arrow to make the fire out place near exit 1, big value as matixBase [pos-1] [pos] = 500; which as <Figure 12> Routing to the exit from P10 to Exit 3 (P30) 1 route. Exit 2(P25) 2 route. Direction evacuation through the arrow shows 10 → 11 → 12 → 18 → 24 → 30 → escape



<Figure 11> Arrow based Fire Zone and Building Structure



〈Figure 12〉 Routing to the Exit After the Fire is Confirmed

〈Table 2〉 Different between Existing Trilateration Method and Purpose NodeMcu According to Performance, Quality and Time

	Performance	Quality	Time
Trilateration Method	System performance is not good incase of complexity	Cannot connect to the internet easily.	Calculation is needed Which Take lots of time
Proposed NodeMcu Method	System performance is good in case of complexity.	It can connect to the internet very fast	No need of calculation Fast and easy process

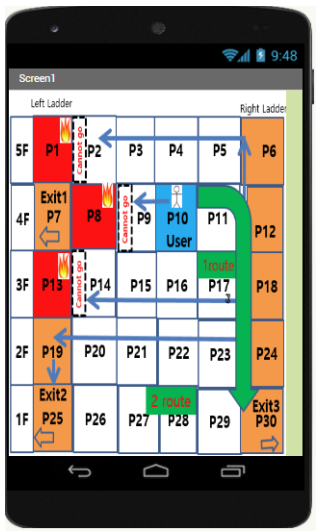
(185) TimeCost (Best Shortest Path). From NodeMcu of the floor map and find out user location. We test for the 4th floor like point P10. Therefore every other 5 floor, 3 floor, 2 floor, 1 floor all be same like this. Therefore we select user location using powerful Wi-Fi signal near fire out place of the same 4 floor In this figure we can see left ladder and right ladder at the both side. This figure is divided into big plot in which we are showing just 5×6 = 30. That means 5 floor are in the row and and 6 plots are in the column. Among 30 plots 4 floor exit 1 side is fire out place. P1. P8 and P13. Even though this is the nearest place from user to escape out from the exit 1. User cannot escape from exit 1. Because it has High TimeCost. So we make algorithm after inserting fireout places 1, 8, 13 bloacked and passover from another route to escape out. Finally we make Exit 3 side the best route for the escape out. Which is the best way. Among 8 routes user can choose this way for the protection from 4th floor to escape out. This is how other all the case will be like above in other floor too.

〈Table 2〉 above shows the Different between Trilateration method and NodeMcu approach method. Even though Trilateration is common localization method. We found NodeMcu is better then Trilateration because of

its Performance quality, and time. NodeMcu can connect IoT device but not Trilateration. This method usually Received Signal out from this side incase of emergency because of its biggest TimeCost. Here different colors and showing to identify user, exit, ladder, shortest route and naming of the 30 plot. Moreover arrows are showing this is specially incase of no electricity too. As we know that incase of fire or emergency early precaution and quick recovery plays a great role. Therefore user can go out from the emergency situation looking mobile phone and the arrows. This figure is indoor map in our algorithm. Later we can use this figure using zoom and making 5F×22 rooms of each floor into P110 nodes of the rooms for the various purpose. which is used to estimate the distance but cannot connect to IoT so it cannot track user incase of emergency situation. User can use the direction and stairs on both sides to escape from exit in case of emergency. Fire out place 421 information can be known from the DB server. User calls 119, reports the situation to the security office nearby, makes it possible to communicate without any problem from the fire [Jung et al., 2016].

4. Implementation of Arrow Guidance System Application

We can installed app from mobile using QR (Quick Response) for arrow guidance. Which can see direction looking east, west, north, south side from mobile upto exits. This app system's visualize smartphone screen can display building structure to the user. Arrows show three Exits, Exit 1 (P7), Exit 2 (P25), and Exit 3 (P30), access data so that the user can see pathation upto exit. Nowadays there are various monitoring tasks incase of emergency which requires NodeMcu kind of location detecting Wi-Fi data more significant ways. Trilateration is the common localization method, but not for exactly for modern building for the safest purpose. Node is the estimating position method in a wireless Sensor Network (WSN), for Computer Aided Design (CAD). This ranged using time based from point to point through connection but trilateration methods is not. It only measure distance but not connections well.



〈Figure 13〉 Arrow Guidance from Mobile

〈Figure 13〉 show arrow guidance mobile app of the building structure which shows corridor on both sides. User detect the fire out place near exit1 as P1, P8, P13 and try to escape from that floor to another. Now sser current position is (P10) from this place arrow show to the (East)side to escape route which is the best shortest path. As a result, user can escape from the emergency situation using arrows as like in mobile above. This is the shortest path in the direction matrix using node architecture arrows for the IPS guidance system based on Wi-Fi system in an emergency case.

3. Result and Conclusion

Fire and disasters have a lot of impact every year, damaging billions of property and nature. Researchers are looking for best ways to reduce these losses using GPS, AI, Wi-Fi, IoT sensors, exploring areas for the future we analyzed and investigated various applications [Rusli et al., 2016]. To solve this problems evacuation guidance system based on node architecture proposed. Make routing arrow navigation using a building structure showing arrows from the mobile [Javaid et al., 2015]. Goal of this paper is to avoid unexpected problem, in dangerous situations. In conclusion, it proved that escape out looking mobile arrow guidance using upto exit. For the future, we will continue to handle large and big buildings of cities by automatically applying navigation methods in real time. Routing algorithm can use new safety methods in large buildings in this modern society. We will continue research using node based evacuation guidance for indoor, using IoT on connecting to mobile. This is most necessary for huge buildings, saving people in emergencies using computer technology is became most for the future. Therefore, indoor evacuation guidance system is an important not only for the number of buildings increases but also for over the world. It requires research, advanced technology to monitor more centuries around the world like our Wi-Fi embedded systems, drone base in real-time for indoor technologies that can be use to minimize human injury. Moreover IoT devices such as beacon, Bluetooth, to can make possible to communicate in emergency situations using technologies to evacuate people in a safe way. Finally to sunmarize results on the number of alternatives technology and pros and cons to guide fire evacuation in buildings includes Trilateration, location recognition, fingerprint, random forest, among them our proposed idea using Wi-Fi system and node architecture provides better performance, quality and time then trilateration method for safe and best route as shown in the mobile <Figure 13> like result.

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