

Automated Mobile Telecom Cell Sites System

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Abstract — Telecommunication is the transmission of traffic from one place to another in a network through a media using mobile station. Cell site is referred to as the base station of telecommunication, it is part of telecom network that allow subscribers to access services from the telecom service providers.

Cell sites depend on core network and transmission system to function, it is not a standalone network. It is the interface between mobile station and the network (core network and transmission system).

In this research, an automated mobile telecom cell site system will be designed and developed. The system will help to provide accurate and reliable online information about cell sites equipment and determine profit or loss from cell sites.

Qualitative research approach will be used in the study while interview will be employed to collect data.

Index Terms — Cell sites, base station, network, telecom.

I. INTRODUCTION

Telecom cell sites otherwise call base station serves as interface between mobile station and the network. In 2G network, it is called Base Transceiver (BTS), it is known as NodeB in 3G network, it is called evolved node B (eNodeB) in 4G network while in 5G network, it is called GNodeB.

Telecommunication is simply the transmitting and receiving of voice or data on telephone via communication media [1].

Telecommunication is made up of the followings:

- Core network. It preforms switching of traffic from the caller to the called party
- Access network: it enables subscribers to access the network services and the cell site is part of the access network that provide services directly to the subscribers,
- Transmission system: it is the media which convey the traffic. The media could be Very Small Aperture Termina (VSAT), fiber cable, digital microwave radio, etc.

A. Problem Statement

The manual system of processing and storing cell sites data in spreadsheet causes inefficiency, inaccurate information and delay in decision making.

B. Objectives of the study

1. To provide accurate and reliable online information about cell site equipment.
2. To determine profit or loss from cell sites.

C. Significance

The automated mobile telecom cell site system will help to provide efficient and accurate online information of equipment status at cell sites and determine profit or loss from each cell sites.

D. Scope of the study

The system will only provide status of equipment and profit or loss from cell sites.

II. LITERATURE REVIEW

Different literatures were reviewed to ascertain challenges or discover exiting problems relating to cell sites.

A. Types of cell sites

- Mobile cell site: it is a portable cell site installed on a vehicle to transmit and receive signals/ traffic. It is often used in an event centers to serve temporary purpose.
- Fixed cell site: it is installed in a specific location to transmit and receive signals/traffic.

B. Features of Cell site

The followings are the characteristics of any telecom mobile cell sites:

- indoor or outdoor site
- transit, hub, backbone, terminal or BSC/RNC/LTE site

C. Equipment at cell site

Mobile telecom cell site could have all or some of the below equipment to transmit or receive signals/ traffic.

- Digital microwave radio (indoor and outdoor unit)
- Digital microwave antenna
- IF/RF cables
- Feeder cables
- Mobile cell tower/mast
- Antenna (2G, 3G, 4G or 5G)
- Rectifier cabinet
- Cabinet (for 2G, 3G, 3G or 5G equipment)
- Power distribution board
- IP55 stand
- IP55 panel for power switchover
- Generator as standby power source
- Fuel tank
- Generator
- Air condition unit for indoor cell site
- Shelter

- Fire extinguisher
- ADM
- DWDM.

Telecom operators use spreadsheet in processing and storing cell sites data and as well as computing profit or loss from cell sites. This manual system is inefficient and the information is not accessible online for quick decision making.

This research will close this gap by designing and developing a web-based system that provide accurate, efficient and reliable status or states of equipment at cell sites and determine profit or loss from each sites.

The use of technology helps in easing exchange of information [2].

D. METHODOLOGY

Qualitative research will be employed in the research because of its flexibility and the research method tool to be utilized in collecting data is interview because it permits attention to details in collecting data [3].

A. Agile Model

The automated mobile telecom cell site will be developed

using agile model because of its ability to adopt to changes and scalability [4].

The Fig. 1 below illustrates the different phases of agile model.

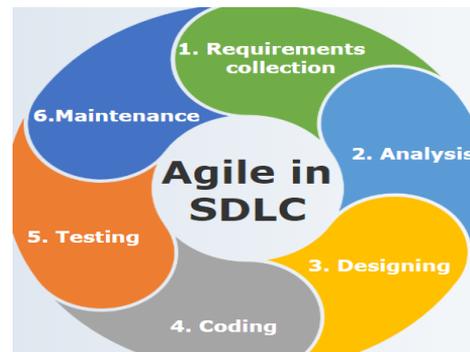


Fig. 1. Agile model.

B. Use case diagram

It shows relationship between users and the system as shown in the Fig. 2 below.



Fig. 2. Use case diagram.

C. Flowchart diagram

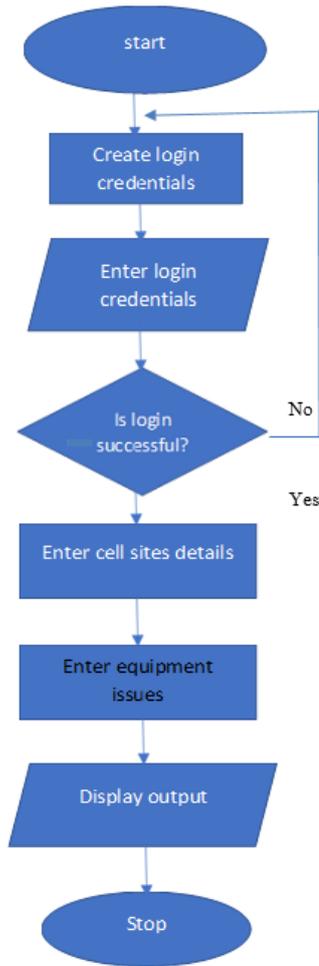


Fig. 3. Flowchart diagram showing the pictorial diagram of the system and logical flow

D. Database field names

TABLE 1: DATABASE TABLE SHOWING ALL THE FIELD NAMES DECLARED AND USED IN THE SYSTEM

Field Names	
Siteid	Acstatus
Region	Atsstatus
Omp	Aviation
Location	earthening
Status	gencapacity
Cost	Genstatus
Revenue	genbatstatus
Profit	Rectifier
gintegrated	Batteries
Gstatus	Issues
trafic2g	Others
trafic3g	Ecgvra
tdependent	Metertype
Idependent	meternumber
Type	Guards
	Comment

E. Database structure

#	Name	Type	Collation	Attributes	Null	Default	Comments	Extra	Action
1	id	int(11)			No	None		AUTO_INCREMENT	Change Drop More
2	siteid	varchar(20)	latin1_swedish_ci		No	None			Change Drop More
3	region	varchar(100)	latin1_swedish_ci		No	None			Change Drop More
4	omp	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
5	location	varchar(200)	latin1_swedish_ci		No	None			Change Drop More
6	status	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
7	cost	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
8	revenue	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
9	profit	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
10	gintegrated	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
11	gstatus	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
12	trafic2g	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
13	trafic3g	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
14	tdependent	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
15	Idependent	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
16	type	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
17	acstatus	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
18	atsstatus	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
19	aviation	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
20	earthening	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
21	gencapacity	varchar(50)	latin1_swedish_ci		No	None			Change Drop More
22	qenstatus	varchar(20)	latin1_swedish_ci		No	None			Change Drop More

Fig. 4. Database structure of cell sites.

F. Programming Development Tools

The automated mobile telecom cell site system was developed with the under listed software development tools:

- following programming tools were used in the development of the system:
- PHP
- HTM
- MySQL
- WAMP

- JavaScript
- Sublime text Editor.

III. RESULTS

A. Source codes

The Fig. 5 to 9 show the system sources code that were developed using the above software development tools.

```

5 <meta charset="utf-8">
6 <meta name="viewport" content="width=device-width, initial-scale=1, shrink-to-fit=no">
7 <meta name="description" content="">
8 <meta name="author" content="">
9
10 <title>ATANIS</title>
11
12 <!-- Bootstrap core CSS -->
13 <link href="bootstrap/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
14
15 <!-- Custom styles for this template -->
16 <link href="bootstrap/css/simple-sidebar.css" rel="stylesheet">
17 <script src="js/jquery.js"></script>
18
19 <script src="js/jquery.js"></script>
20 <!-- <link rel="stylesheet" href="bootstrap4/css/bootstrap.min.css">
21 <script src="bootstrap4/js/bootstrap.min.js"></script -->
22
23 <link href="bootstrap/vendor/bootstrap/css/bootstrap.min.css" rel="stylesheet">
24 <link rel="stylesheet" href="MDB/css/addons/datatables.css">
25 <link rel="stylesheet" href="datatables/css/jquery.dataTables.css">
26 <link href="DataTables/DataTables/css/dataTables.bootstrap4.min.css">
27 <link href="MDB/css/bootstrap.css" rel="stylesheet">
28
29 <link href="alert/alert/css/alert.css" rel="stylesheet">
30 <link href="alert/alert/themes/default/theme.css" rel="stylesheet">
31

```

Fig. 5. Source codes.

```

72 <div class="d-flex" id="wrapper">
73
74 <!-- Sidebar -->
75 <div class="border-right" id="sidebar-wrapper" style="background-color:royalblue">
76 <div class="sidebar-heading" style="color:white;font:bold 25px arial"> A T A N I S &#174</div>
77 <div class="list-group list-group-flush">
78
79 <a href="" id="dashboard" class="list-group-item list-group-item-action btn-info" style="background-color:#55a5d0">
80 <a id="tab1div" class="list-group-item list-group-item-action btn-info" style="background-color:#55a5d0"><b style
81 <ni id="tab1" style="display:none">
82 <a href="landlord.php" id="dashboard" class="list-group-item list-group-item-action btn-info" style="background-co
83 <a href="security.php" id="dashboard" class="list-group-item list-group-item-action btn-info" style="background-co
84 <a href="guards.php" id="dashboard" class="list-group-item list-group-item-action btn-info" style="background-col
85 <a href="incident.php" id="dashboard" class="list-group-item list-group-item-action btn-info" style="background-
86 <a href="power.php" id="dashboard" class="list-group-item list-group-item-action btn-info" style="background-color
87 <!--<a href="vendor.php" id="dashboard" class="list-group-item list-group-item-action btn-info" style="background-
88 </ni>
89
90 <a id="tab2div" class="list-group-item list-group-item-action btn-info" style="background-color:#55a5d0"><b style
91 <ni id="tab2" style="display:none">
92 <a href="cell_site.php" id="" class="list-group-item list-group-item-action btn-info" style="background-color:#244
93 <a href="issues.php" id="sc" class="list-group-item list-group-item-action btn-info" style="background-color:#244
94
95
96 </ni>
97
98
99

```

Fig. 6. source codes.

```

363 <div class="form-group">
364 <label for="exampleInputEmail1"><span style="color:red">*</span>Region</label>
365 <input type="username" class="form-control" id="region" >
366 </div>
367
368
369 <div class="form-group">
370 <label for="exampleInputEmail1"><span style="color:red">*</span>OMP</label>
371 <input type="username" class="form-control" id="omp">
372 </div>
373
374
375 <div class="form-group">
376 <label for="exampleInputEmail1"><span style="color:red">*</span>Site Location</label>
377 <input type="username" class="form-control" id="location" >
378 </div>
379
380
381 <div class="form-group">
382 <label for="exampleInputEmail1"><span style="color:red">*</span>Site Status</label>
383 <select class="form-control" id="status">
384 <option>Operational</option>
385 <option>Non Operational</option>
386 <option>Decommissioned</option>
387 <option>Not Completed</option>
388 <option>No Site</option>
389 </select>

```

Fig. 7. Source codes.

B. Cell site status

Figure 8: It displays cell site information such as site ID, region, contractor, site location, site status, operational cost,

profit/loss, revenue, 3G integration, 3G status, 2G integration, 2G status, etc.

#No	SITE ID	MAIN ISSUES	OTHER ISSUES (IF ANY)	IMPACT ON SITE	ACTION TAKEN BY	COMMENTS	REPORTED BY	ACTION
1	BEN001	Transmission Equipment Fault/Failure	ADM CSE card is bad	All depended sites are down	Head office to send replacement of the card	Immediate replacement of the card is needed	EHIGIATOR EGHO-PROMISE	 

Fig. 8. Network issues interface

C. Cell site issues

Figure 9: It displays different problems affecting cell sites equipment and who is responsible for fixing the problems.

#NO	SITE ID	REGION	OMP	SITE LOCATION	SITE STATUS	OPERATIONAL COST	PROFIT / LOSS	REVENUE	3G INTEGRATED	3G STATUS	3G TRAFFIC
1	BEN014	NORTHERN	DCTL	Tamale	Operational				Yes	Up	

Fig. 9. Cell sites management interface

IV. CONCLUSION AND RECOMMENDATION

A. Conclusion

Based on the results above, the automated mobile telecom cell site system has been effectively developed using a reliable software development model. The system provides accurate and reliable online information about the status of equipment at cell sites and determine profit or loss from such sites.

B. Recommendation

We suggest that the automated mobile telecom cell site system should be implemented by telecom service providers because of its numerous benefits mentioned above. We further recommend that web-based spares management system should be developed to provide early warning of any equipment before it affects services.

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