Secure System for Base Transceiver Station

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Abstract— In mobile communication the Base Transceiver Station (BTS) site and the tower maintenance play an important role. Our paper makes an use of GSM modem which gives the instant message which detects the errors occurring in this device. The major problems faced including the theft of wires, fuel amount being unnoticed, unauthenticated entry, the fluctuation of temperatures, the vendor and the technician’s time management in of above defined problems. The method of GSM modem which gives the instant message about the each activity happening in the site. The temperature sensors will sense the temperature of the room and if it rises above the threshold value the GSM module will send the message to the master mobile which is already set in the system. The RFID authentication system used to access the door of BTS sites. In addition the site is under the surveillance of CCTV camera which turns ON automatically. The cell site Base Transceiver Station (BTS) which are operated by Diesel generator can be controlled manually or can be put in automatic mode.

Keywords— Mobile Station, BTS Shelter, Sensors, GSM, Arduino.

I. INTRODUCTION

Cellular towers form the backbone of our modern communications infrastructure. Each tower is incorporated with a power plant with batteries, diesel generator, tank for backup power, air-conditioning and power conditioning unit. The sensors that monitor temperature, diesel fuel levels, site door open/close status. In addition the site is under the surveillance of CCTV camera which turns ON automatically whenever the site door is opened as a safety measure. Door open/close controller is used for the automatic door opening and closing [1]. The site door can be accessed only through the RFID authentication system. This data is continuously monitored at base station site and fixed or desired or threshold limit, a message is send to network operators on mobile through GSM for limiting and controlling actions the software and hardware, in which include wireless nodes and implementation data transmission module are use to implementation of system. Because of wireless system used for transmission, flexible networking for monitoring equipment, low cost and convenient installation and high capacity and reliable nodes This wireless system overcome the disadvantages of wired system [2].

This paper aims a single comprehensive solution that remotely controls and monitors the subsystems inside each base station site and enables network operators to coordinate and manage the conditions at all base station sites across their network. Time management of cell sites in case of any failure, protects the cell network, tracks and measures cell site performance for peak operation.

II. BACKGROUND

2.1. Aim and Objectives

Aim of this paper is to be providing remotely controls and monitors the subsystem inside each base station site and provides the instructions or information for network operators to manage the conditions at base station site. Control numbers of sub systems in base station site. Objectives of the BTS paper are to provide the achievements of (Accelerated Mobile Phone Expansion) AMPE Programmed which targets the achievements of full voice coverage. When temperature rises then alerting users immediately to reduce damage to cell sites.
2.3 Problem Solution

- Theft of copper wires: The site room is under the cover of CCTV camera. The site room includes door open/close sensor. Whenever any person enters the room the message is sent to the site admin and CCTV camera will turn ON.
- Temperature Fluctuation: The system includes a temperature sensor within the Site. If the site temperature rises above the maximum allowed value, the system automatically opens the site door and sends this information message to technician.
- Generator fuel Level Management: A fuel gauge indicator is provided in the generator fuel tank. When the fuel level goes below the set value a message is sent to the Technician requesting for refilling. All fuel filling records are saved in the database.
- Unauthenticated Entry: The system includes a RFID Reader at the door entry. This setup opens the door only if valid card is moved across the reader. All entry records like Time, person information etc are saved in the database. While leaving the site the person has to move the card before RFID reader again to close the door [3].

III. SYSTEM DESIGN

The design steps and working principles of the system is organized into two different units like Hardware unit and Software unit. Hardware unit includes micro-controller, power supply section, display section, sensor unit, and alarm. Software unit includes the compiler to build the assembly program used in ARM microcontroller.
The whole site room is under the cover of CCTV camera. The site room includes door open/close sensor. Whenever any person enters the room the message is sent to the site admin and CCTV camera turns ON. The system includes a temperature sensor within the Site. If the site temperature rises above the maximum allowed value, the system automatically opens the site door and sends this information message to technician.

As shown in the above figure, the system includes a RFID Reader at the door entry. This setup opens the door only if valid card is moved across the reader. All entry records like Time, person information etc is saved in the data base. While leaving the site the person has to move the card before RFID reader again to close the door. A fuel gauge indicator is provided in the generator fuel tank. When the fuel level goes below the set value a message is sent to the Technician requesting for refilling. All fuel filling record can be saved in the database.

3.1 Purpose of Using Each Component

- ARM7: To read the status from each component and to actuate the controlling devices.
- Diesel level Sensor: To sense the level of diesel in the diesel tank, these power the BTS in case of main power cut.
- LM35: Senses the BTS room temperature.
- Door open/close sensor: This gives the status of door as whether it is closed or opened.
- PIR Sensor: Detects the presence of humans inside the room.
- CCTV Camera: Records the status of the room.
- LCD Display: To display the temperature, Diesel level and other parameters of the BTS.
- Hydraulic Door Opener and Closer: To open and close the door automatically.
- Relay: To switch the AC or High voltage DC devices.
- GSM modem: To send the message about BTS status.
- RFID Reader: To allow only authenticated entry.

3.2 Component Description

- PIC18F4520: It is High-performance RISC CPU & only 35 single word instructions to learn. Operating speed of PIC18F4520 is DC-20MHz clock input DC- 200ns instructions.
- LM35: Temperature Sensor: The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 thus has an Advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration to provide typical accuracies of ±1/4°C at room temperature and ±3/4°C over a full −55 to +150°C temperature range.
- 16x2 LCD Display: LCD (Liquid Crystal Display) screen is an electronic display. These modules are preferred over seven segments and other multi segment LEDs. The reasons being: LCDs are economical; easily programmable; have no limitation of displaying special & even custom characters (unlike in seven segments), animations and so on. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in 5x7 pixel matrix. This LCD has two registers, namely, Command and Data. As our system incorporates ARM2148 Microcontroller board which operates on 5V DC supply, same can be used to power the LCD.
- SIM300 GSM Modem: GSM (Global System for Mobile Communications) is the most popular standard for mobile telephony systems in the world. In this paper we used GSM modem which has SIM300 Module. This is a plug and play GSM Modem with a simple to interface. We can use it to send SMS, make and receive calls, and do other GSM operations by controlling it through simple AT commands from LPC 2148 micro controller.
- RFID Reader: Radio-frequency identification (RFID) is the wireless non-contact use of radio-frequency electromagnetic fields to transfer data, for the purposes of automatically identifying and tracking tags attached to objects. The tags contain electronically stored information typically
incorporated into a product, animal, or person for the purpose of identification and tracking using radio waves. A typical RFID system is made up of three components: Tags, Readers, Host controller system.

- **Door Open/Close Sensor**: It is Iron Door Magnetic Sensor MC-58. Monitoring the door switch state, output ALARM switch signal. The two magnets included in the sensor are placed a short distance apart. One of the magnets is placed on the door, while the other is usually placed on the door frame. The magnets need to be spaced properly, in order to ensure that they have a magnetic connection. The sensor monitors the integrity of the connection between the two spaced magnets. If that connection is broken, the sensor is triggered, and a signal is sent back to the control panel, which is processed as an alert.

- **Diesel Level Sensor**: Diesel level sensor consist of Magnetic switch / Read switch. It will not come to contact with Water i.e. Shock proof. Switch is made up as a free movement switch, when switch is free O/p will be Open NO. When the switch is in UP with Liquid - O/p will be Closed NC. It operates with V DC. It can be used to detect any Liquid level.

- **PIR Sensor**: PIR sensor senses motion, almost always used to detect whether a human has moved in or out of the sensors range. PIRs are basically made of a Pyroelectric sensor, which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. They are small, inexpensive, low-power, easy to use and don't wear out. They are often referred to as PIR, "Passive Infrared", and “Pyroelectric”.

### IV. DESIGN AND DEVELOPMENTS

First step is to initialize all the required variables once initialization is done next flow is to set the ADC channel AN0 from AN0 to AN3 as analog channels , next initialize LCD and display some data’s on LCD to check the working of LCD. Initialization of UART for 9600 baud rate is the next step. Baud rate settings are done by using registers of UART. Next step is initialize send and receive message to GSM module.

Once initialization, displaying done, initialize the UART at 9600 baud rate to communicate with RFID and GSM modules. Then start waiting for any system GPIO state changes connected. If an RFID card is detected then read the card ID and compare with stored IDs. If valid card is shown then open the door by actuating the hydraulic door opener, send the entry details to the technician, turn on the CCTV camera and start displaying the current state of sensors. If the card ID is not valid then just send alert message to technician. If the temperature is above the normal value then open the door and send alert message to technician and turn on video recording. If diesel level is low then send the message to the technician to inform him about the diesel level status.

Testing is necessary to check whether device or module working properly or not. There are many methods for testing. Here we have followed two testing strategy, those are Unit testing and Integration testing.

### V. CONCLUSION

In this paper all the modules are working as expected and stated in objectives of paper. In this introduced beneficial techniques to protect the BTS site and its proper uninterrupted operation like, BTS Security Monitoring enables users to monitor remotely the conditions of base transceiver stations (BTS). The core of the solution is the GSM SMS controller which always performance monitoring features. Great time management and hence required less number of technicians. This system does not demand any changes in the existing infrastructure to install it; it can be used as add-on to the existing system. With the help of this system the technician is alerted of any unexpected situation and can attend to it immediately and hence the loss is minimized.

### A. Limitations

The user has to use the RFID card to enter the base station. The only limitation of this paper is that the user cannot enter the premises if he/she forgot his RFID also the RFID data is time critical i.e. the user with proposed time slot can only enter the premises at the given time. The user cannot
enter the premises at any time as they may please. The user has to carry the RFID tag at all times. The users that might have lost their cards will have to contact the administrator.

B. Future Enhancements

This paper can further be extended to remotely located machinery systems. It can also be suitable to extend the services which need maintenance like temperature, pressure etc.

REFERENCES