

ARM Based Security & Safety System for Base Transceiver Station

S. A. Shaikh¹

Pravara Rural Engineering College,
Loni, Ahmednagar, Maharashtra, India.
shakils68@rediffmail.com¹

P. R. Gavhane²

Pravara Rural Engineering College,
Loni, Ahmednagar, Maharashtra, India.
pramilakadam91@yahoo.com²

Abstract—The main aim of this system is for Maintenance, Safety & Security of Base Transceiver Station (BTS) site and the tower. The major problems faced include the theft of Wires & Diesel, the fluctuation of Temperatures, unauthorized person entry, unnoticed fuel amount, Current taken by load and the technician's time management. The instant message about the each activity happening in the site given by GSM modem. 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 mobile. The temperature values are displayed on LCD, the controller gives command to cooling Fan to ON & Real time Images recording on PC by using MATLAB software with GUI. The cell site Base Transceiver Station (BTS) which are operated by Diesel generator. When the fuel level goes below the set value a message is sent to the technician requesting for refilling & with Real time Images recording with on PC by using MATLAB software. Door open/close sensor is used for indication of door opening and closing. Wire Theft Status indicated by IR Sensor. The site door can be accessed only through the RFID system. The situation in the site is updated to the technician through messages. PIR sensor used to detect the presence of humans inside the room. The system includes a Current sensor to measure Load Current & Humidity Sensor to sense humidity of BTS room with Real time Images recording on PC. Camera record BTS room. The value of Temperature & Humidity of BTS room, Diesel Level of Generator & Load Current are Logged in PC with respective time & date.

Our project improves the performance ability of BTS. This technique is remote controlling and monitoring can be implemented at each and every BTS tower to look after the safety and management of its network.

Keywords-ARM11, GSM, RFID, IR Sensor, PIR sensor, LM35, MATLAB, BTS.

I. INTRODUCTION

The BTS cabinet with tower is incorporated with Diesel generator, Cooling Fan, Current Transformer, PIR Sensor, Temperature & Humidity Sensor, Door Open/Close Sensor, RFID Reader Module, Wire Theft Sensor & GSM Module. The sensors that monitor Temperature & Humidity of BTS room, Diesel levels of Generator, Site Door Open/Close status, Load Current, Wire Theft Status, & Authentication person entry. This project aims a single comprehensive solution that remotely controls and monitors the subsystems inside base station site.

Module are placed in inside BTS room for monitor & control above the parameters with the help ARM cortex M3 LPC1768 board with PC, RFID Reader Module & GSM Module. The said parameters value are displays on the 16X2 dot matrix LCD display, simultaneously transfers the parameter data to PC via RS232 link, & send message to technician using GSM Module. The program written in 'C' for ARM processor getting the data from different sensors. MATLAB Software with GUI in PC is used for Real time Image Recording of Diesel Level, Load Current, Humidity & Temperature of BTS room.

II. RELATED STUDY

The monitoring and management of powering and conditioning systems within a remote mobile telecommunication site is to be proposed by Pizzutiet.al [1]. Paschke et.al proposed system is based on client-server architecture, providing data to main monitoring centers using controllers located at telecom sites or with technological controllers of supervised power and air conditioning systems [2]. The detail about monitoring of all technical infrastructure equipment on site power system, HVAC, security, access control system, fire alarm system, copper wire protection is possible by one controller gives by Piotr Paschke et.al [3]. Sadeque Reza Khan et.al suggested FCU is an electronic instrument that records the temperature data and takes decision according to that data using PIC18F4520 which includes 10 bit ADC for data conditioning [4]. Sadeque Reza Khan et.al uses Voltage Temperature Monitoring System or VTMS for synchronization of the operation of Generator and battery with Microcontroller PIC 16F877A [5]. Ashish Kashyap et.al suggested TMS320F28031 DSP chip controller are to measure & calculate various metering parameters such as voltage, current, power, temperature of BTS [6]. To sense Various parameters related to BTS like Diesel Level, Temperature, Human intrusion, Door Open /Close & controlled, monitor it by ARM 7 Microcontroller. Alerting

users immediately by SMS using GSM about the activity happening in BTS room proposed by ChetanPatil et.al [7]. ArunAlla et.al proposed controller ARM 9 also maintain the room temperature under a predetermined value by controlling the Fan Unit. If the values exceed beyond the threshold limit this information is messaged to user using GSM module [8]. Swati Chhajed et.al proposed the faults are fed into a remote user device with the help of GSM modem creating a message instantly [9].

III. PROPOSED SYSTEM

The design system is organized into two different units like Hardware unit and Software unit. Hardware unit consist micro-controller, power supply section, display section, sensor unit, relay, RFID & GSM. Software unit includes the 'C' program used in ARM microcontroller & MATLAB with GUI in PC.

Fig.1. Shows the block diagram of the proposed method. In this ARM LPC1768 along with other peripherals Relay, LCD, PIR Sensor, GSM module, RFID module ,IR Sensor, Current Transformer, Level Sensor ,Phase detector ,Temperature Sensor & Humidity Sensoretc.

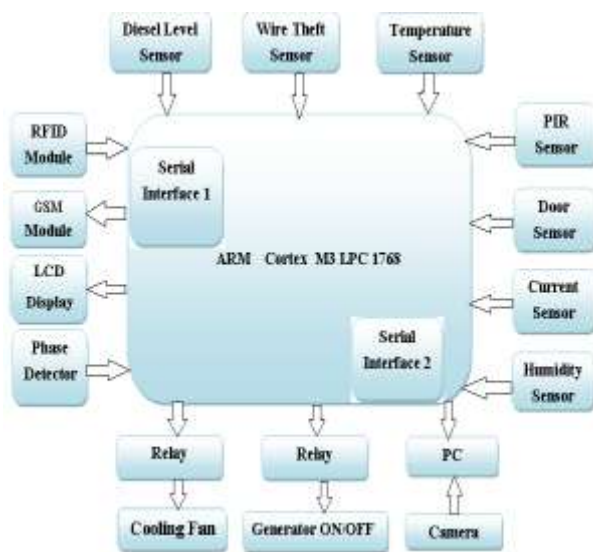


Fig. 1: Block diagram of System Model.

Camera: The whole site room is under the cover of camera. It give inside images of BTS room & save it in PC.

Door open/close sensor: The site room includes door open/close sensor. IR Sensor for indicating the door open/close status .To send SMS about door open/close status to technician. The door is open for authentication person only.

LPC 1768 ARM cortex -M3:The value of Temperature & Humidity of BTS room, Diesel levels of Generator, Site Door Open/Close status, Load Current, Wire Theft Status, & Authentication person entry To read the status from each

sensor. The data from ADC is sent to microcontroller for process, Microcontroller constructs it. The said parameters value are displays on the 16X2 dot matrix LCD display , simultaneously transfers the parameter data to PC via RS232 link, & send message to technician using GSM Module .To send real time images recording on PC terminal using RS232 of Diesel level of generator, Temperature & Humidity of BTS inside room & Current of load parameter & display value of parameter on LCD.

LM35 Temperature Sensor: Problems occur with the fluctuation of site temperature. The site machineries work at specific temperature, if temperature goes above some value then they may get permanent damage. 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 mobile. The values are displayed on LCD, the controller gives command to Cooling Fan to ON& graphical real time Images recording on PC terminal by using MATLAB software with GUI.

16x2 LCD Display: To display BTS inside room Humidity &Temperature, Diesel level of generator, Door open/close status ,Human intrusion, Wire Theft Status, Load Current, Generator ON/OFF ,MSEB present & authentication person entry.

SIM 900: GSM Modem: GSM (Global System for Mobile Communications) is the most popular standard for mobile telephony systems in the world. In this project we used GSM modem which has SIM900 Module. This is a plug and play GSM Modem with a simple to interface. We can use it to send SMS of BTS inside room Humidity & Temperature, diesel level of generator, door open/close status, Human intrusion, wire theft status, & authentication person entry to technician. GSM operations by controlling through simple AT commands from LPC 1768 micro controller.

RFID Reader: The system includes a RFID Reader at the door entry. This setup opens the door only if valid card is moved across the reader Door are open.

Diesel Level Sensor :IR level sensor used to sense information about fuel level & send to ARM cortex-M3 for processing.

PIR human Intrusion 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.

Current Transformer :The system includes a Current Transformer within the site to measure load Current & its Real time Images recording on PC terminal by using MATLAB software.

Wire theft Sensor: IR Sensor indicate wire is theft by human or not.

The Proposed method flow chart is as shown in Fig. 2

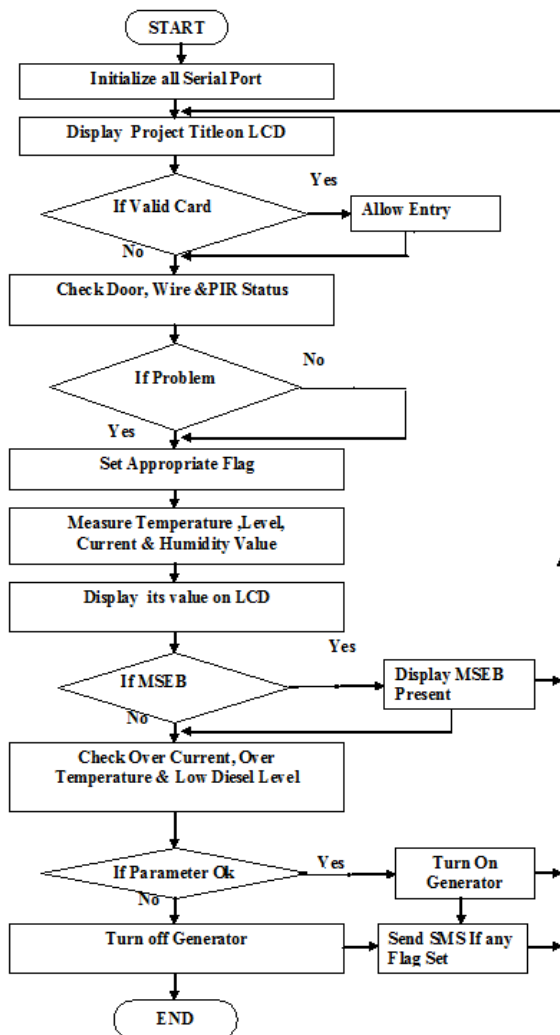


Fig.2. Flow Chart of execution

IV. ALGORITHM

1. Start.
2. Initialize All Serial Ports.
3. Display the Project Title on LCD.
4. If valid card ,yes allow the entry. If no, check Wire ,Door & PIR status.
5. If any flag occur yes ,Set Appropriate Flag.If no measure Temperature & Humidity off BTS Room ,Diesel Level & Load Current.
6. Display its value on LCD.
7. If MSEB present yes, Display the MSEB present. If no ,Check Overload Current ,Over Temperature Low Diesel Level.
8. If above parameter OK, Generator get Turned ON .If no, Generator get turned Off .
9. Send SMS if any flag Set & go to Step 3.
10. Stop.

V. RESULT AND DISCUSSION

In this work Data Storage & Real Time Image of Parameter on PC.LCD Display Result such as Authentication Person Entry , Door Open/Close Status , Wire Theft ,Intruder Alert ,Temperature & Humidity Value of BTS room,Diesel Level of Generator , Load Current Value,MSEB Present ,Generator ON, SMS 2 Sending , SMS3 Sending, SMS 1 Sending, Overload Temperature.Alerting Technician by SMS1,SMS2& SMS3 on mobile.

The Real Time Images Recording on PC of Diesel Level of Generator value, Temperature & Humidity of BTS inside room value & Load current value shown in below Fig.3.



Fig.3 Real Time Image Recording on PC of Parameter.

The value of Diesel Level of Generator, Temperature & Humidity of BTS inside room & Load current are logged in PC with respective time & date as shown in below Fig.4.

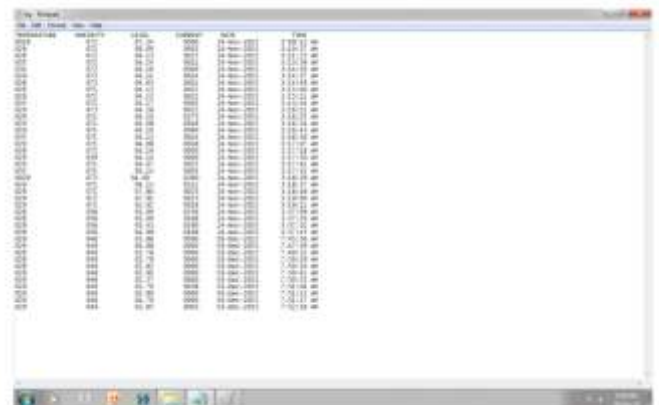


Fig. 4 Data Storage of Parameter In PC.

Temperature & Humidity value ,Diesel Level of Generator value, Door Open/Close status, ,Wire Theft Status, Authentication Person Entry , Intruder Alert, Load Current Value, Overload Temperature ,Overload Current& Generator ON /Off . The messages of all above parameter are display on LCD. If Low Diesel Level ,Generator get Off display on LCD as shown in below Fig.5.



Fig. 5 Generator Off Message Display on LCD.

Alerting technician immediately when temperature rises above threshold value, Low Diesel Level of Generator, Door Open Status, Wire Theft Status, & Authentication Person Entry, Over Load Current Value & Generator ON by SMS. If door open, wire theft & Intruder Alert, Sending SMS 2 to Technician on mobile. When Temperature rises above threshold value, Fan get ON & Generator get off. Sending SMS 3 to Technician about Low Diesel Level & Overload Current at this time Generator get Off. When MSEB ON, Generator ON then Sending SMS 1 to Technician on Mobile. If door open, wire theft Intruder Alert & Generator off at same time, first sending the SMS2 after sending SMS 3. If Door Open, Wire Theft, Intruder Alert & Generator ON at same time, first sending the SMS2 after sending SMS1 on technician mobile. The Fig. 6 show SMS 2 & 1 Sending to Technician on Mobile respectively. Generator get off, when Temperature rises above threshold value, about Low Diesel Level & Overload Current.

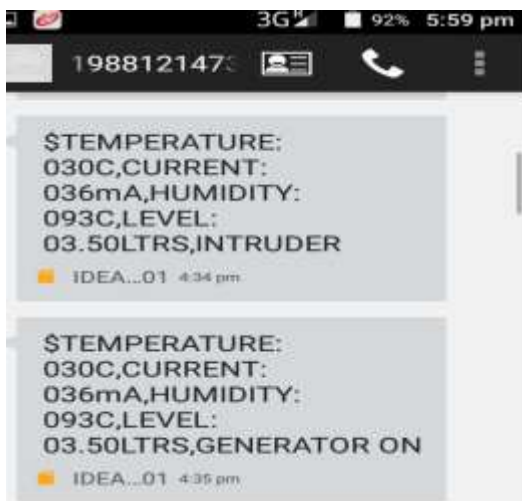


Fig.6 SMS 2&1 Sending to Technician on Mobile.

VI. CONCLUSION AND FUTURE SCOPE

This paper presents the design and implementation of a low cost BTS security system. Many previous works require the user to type and send a Short message to send command to the system. But this paper presents a unique and easy way to control appliances and as well as to get notified about the present condition of the BTS cabin. The whole system was implemented by designing a PCB board which is also very small in size. Reduced size makes it more applicable for commercial manufacturing and distribution. This project introduced beneficial techniques to protect the BTS site. BTS Security Monitoring enables to monitor remotely the conditions of base transceiver stations (BTS). With the help of

this system the technician is alerted at any unexpected situation and can attend to it immediately and hence the loss is minimized. Great time management and hence required less number of technicians. By using Microcontroller the maintenance of BTS can be very well attended in proper way in shortest possible time, So the complexity and time consumption in finding the faults is reduced. This project can further be extended to remotely located machinery systems. This project can also be suitable to extend the services which need maintenance like pressure, smoke detector etc. This project can also be suitable to be modified, to control through internet, so that the user can log in through internet to control the appliances and get real time notification of the status of the sensors by using.

In future, this whole system may be tried to create in compact size, lightweight weight, a lot of accuracy and in real time response.

REFERENCES

- [1] Pizzuti, Grossoni, Antonetti, "Power and Conditioning Telemanagement Integrated System," Twenty-Seventh International Telecommunications IEEE Conference, Sept 2005, pp.83-88
- [2] Paschke, Klis, Grunt, "Integrated Management System for Technical Infrastructure of Telecom Sites", 29th International Telecommunications Energy IEEE Conference, 2007, pp.249-254.
- [3] PiotrPaschke, MaciejPlonczak, PawelKlis, Marek Grunt, "Perspectives of Development of Integrated Monitoring System Of Power Supply and Air-Conditioning Equipment Towards Technical Environment Equipment Monitoring System of the operator", 30th International Telecommunications Energy IEEE Conference, Sept 2008, pp.1-6.
- [4] Sadeque Reza Khan, Ahmed Al Mansur, AlvirKabir, Md. Modasshir, Ahmed AMarouf, "Design of Data Acquisition System Implemented with a Free Cooling Unit (FCU) Controller For a BTS Room", International Journal of Scientific & Engineering Research, Volume .3, Issue- 2, February-2012, pp1-4.
- [5] Sadeque Reza Khan¹, Siddique Reza² and Arifa Ferdousi³ "Voltage Temperature Monitoring System (VTMS) for a BTS Room", International Journal of Instrumentation and Control Systems (IJICS) Vol.2, No.4, October 2012, pp. 1-9.
- [6] AshishKashyap, Dr. Neelu Jain, "Design of Power Management Controller for BTS Power Plant Monitoring based on TMS320F28031 DSP", International Journal of Advanced Research in Computer Science and Software Engineering Volume. 3, Issue -11, November 2013, pp.309-314.
- [7] ChetanPatil, ChannabasappaBaligar, "Base Transceiver Station (BTS) Safety and Fault Management", International Journal of Innovative Technology and Exploring Engineering (IJITEE), Volume-3, Issue-7, December 2013, pp.49-52.

-
- [8] ArunAlla ,Dr. P.NageswaraRao , “Design of Data Acquisition System for a Base Transceiver System Room Using ARM Processor ”,International Journal of Electronics Communication and Computer Technology (IJECCCT) ,Volume.4 Issue -3, May 2014, pp.664-667.
- [9] Swati Chhajed, DivyaGhiya, PriyaLalwani, “GSM Based Fault Alert System for BTS (Mobile Tower)”,International Journal of Modern Trends in Engineering and Research (IJMTER),Volume .2, Issue -7, [July-2015] Special Issue of ICRTET’2015, pp.1381-1385.

Authors

1. Mr. S. A. Shaikh is ME, working as an Associate Professor in PREC, Loni, India.
2. Miss P. R. Gavhane is the student of ME, ETC at PREC, Loni, Maharashtra, India and working as the lecturer in PDVPIET, Loni.