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Design and Development of General Purpose Alarm Generator for Automated System

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***Abstract:** This paper presents a model for general purpose alarm generator for various industrial and defence applications. It can be used to monitor status and remote alarm generation. GSM interfaced microcontroller based system is used to provide basic protection form generic problem. The system can be connected to the online or offline server. When system is power on it is always ready to response for its triggering input. Whenever any undesired event occurs it provides instantaneous audio-visual alarm in located area and sends SMS alert to pre-defined persons. This SMS contains information about that condition and the location of area where it is generated. It also informs higher and appropriate authorities about situation in that area. A control room person can send any number of messages to update real time conditions via online server. More than one alarm generator can be connected with each other in a particular area to work either independently or simultaneously. IoT based android application is also used to notify higher authority with real time location and status of situation*
***Keywords:** Alarm Generator, GSM, I2C, Remote controlled, IoT*

I. INTRODUCTION

An early monitoring and detection of an undesirable event can prevent catastrophic damage. Alert for events like Tsunami alert, Earthquake alert, intruder alert and many more, should be triggered timely to save lives. If any such an event occurs then people as well as public authorities should be informed properly and accurately. These notifications should update concern persons precisely with real time status. To do so a network is required which can reaches to large amount of people simultaneously and that should stand operated even in natural disaster condition. IoT (Internet of Things) based well-structured network along with GSM (Global System for Mobile communication) provides a feasible solution for this problem. GSM based mobile services has already reached to everyone's pocket due to its well established infrastructure and general public network. GSM provides large and vast connectivity among people in India. IoT based intra-infrastructure enhances more connectivity to remotely controlled device.

Various models of alarm generations have been already presented for GSM based threat detection, home automation, security implementations and many more applications [1-6]. In each models, scholars have presented their own way of alarm generation with some enhancement in energy efficiency, cost handling, security features etc. Inside any autonomous or manual security device an alarm generator unit is essential which aware the concern person about the security situation. For an industrial, defense or personal use this alarm generator unit is very critical. Although various alarm generation units have different uses but they are designed for the same purpose. Whenever researchers or designers have to redesign a particular device, it not only cost extra money but also invaluable time of those designers [3-5]. To solve this issue this paper presents a model for generic, modular, remotely controlled, low cost alarm generator for automated or manual systems. It has generic architecture along with modular connected devices which enables us to integrate the device with many applications with different scopes. It also saves NRE (Non-Recurring Engineering) cost of device and save designer time which make this device ultimately cheaper. The present device can be activated with manual triggering, software based event or server based secure inputs. These triggering methodologies enhance its remote controlled capability.

II. SYSTEM ARCHITECTURE

The system is designed work in two modes either offline or online mode. As we can easily analysis from the block diagram shown in figure 1 and figure 2 of offline and online system respectively, the same system when connected with server mainframe via internet becomes online system. The system work on two different power supplies 12 V for GSM module, Buzzer, Flashlight and 5V for rest of the device. The device contains battery backup system along with battery charger module. 12V, 7Ah battery can be connected with module. Central processing unit is the brain of device. Rests of peripherals are modular in nature. With reference of this device modularity enable end user to decide which peripherals are going to be connected with the alarm generator. Central processing unit of the device contains 8051 compatible architecture. 8051-Microcontroller (AT89S51) is used due to its high availability, cost efficiency and support features. This microcontroller is attached with various peripherals as-EEPROM, buzzer,

Flashlight, GSM. To control and manage its modularity various control inputs are also provided. Each control input is highlighted by corresponding LED Light. Whenever a peripheral module is activated corresponding green LED display its status otherwise corresponding red LED displays that module is deactivated by the user at the time of installation. An easy way to comply with IJRASET paper formatting requirements is to use this document as a template and simply type your text into it.

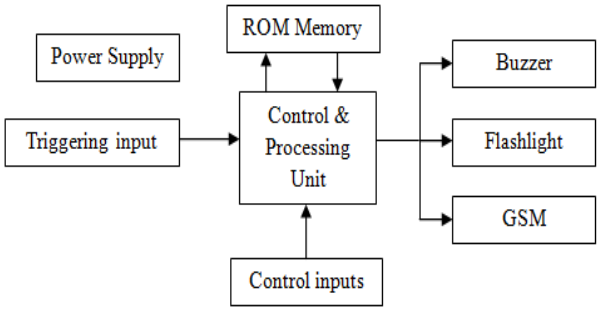

Fig.1 Block diagram of Offline System

EEPROM ROM (AT24C02) memory is used to store predefined mobile number for both modes. When the device is working in offline mode then GSM will send the alert or update messages to only those numbers which are previously saved in this EEPROM. But when working in online mode then user has to give control command at the time of installation that the device takes the mobile numbers from EEPROM or server administrator will give the mobile numbers via serial communication for every alert or update. I2C interface is used to connect EEPROM with microcontroller. Buzzer is used for audio and Flashlight is used for visual alert. Both the devices are operating at high voltage then connected with the help of relays to microcontroller.

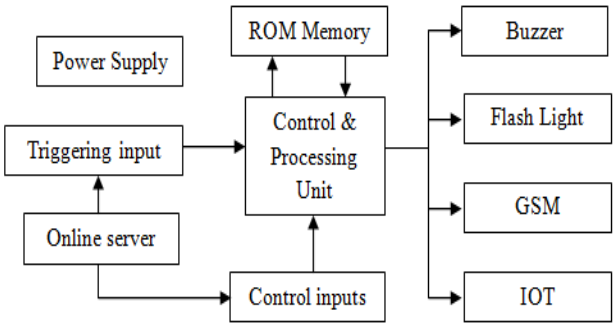

Fig.2 Block diagram of Online System

GSM module (SIM900A) is connected with the microcontroller with serial communication. User has to specify the way of initial alert at the time of installation either call alert or Message alert. GSM module takes the mobile number and messages either from EEPROM or online server. Send the proper message according to the instructions and wait for the 40 seconds to receive the message. If message is not received in given time then module retransmit the message. If still message is not receive within 120 seconds then module makes call alert to the end user emergency number specified at the time of installation. In the case of online mode, if the message is not received in pre specified time of 120 Seconds after retransmission, the server gives this task to adjacent device and process is repeated one more time. If still message is not received then server can connect an alert call mode to all or specified numbers.

For its own intranet connectivity the device has facility to interface it with XBEE based secure network. In online mode the device has to be connected with server all the time for this purpose XBEE-S2 is interfaced with microcontroller. XBEE provide device-device-server connectivity in the sense of various topologies as accepted at the time of installation. It receives the data (Triggering input, mobile numbers, messages and other instructions) form the server and provides those data to the microcontroller. Many sensing units can be connected to the various alert generator units with its own interconnectivity network via online servers. Online server connected android application for real time update is used to aware people about an alert. Android app gives ease of operation and facility for a user to give real time updates to other users

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III.SYSTEM MODELLING

Presented system is designed as various small units and integrated together to work as complete device. A software program has been developed to direct microcontroller along with its peripherals about their task and conditions on various situations. It has been developed in language embedded C on Keil platform. Flow chart for base model of that program is shown in the figure 3. Whenever device is powered on it first initializes all of its peripherals according to the control input; check their status and perform full system health checkup. Then it directly goes on wait condition where it waits for triggering input either by external command or interrupt based. Whenever triggering input is received then it just blows the alarm with every possible way of its peripherals. Various safety features are also been implemented on sub layer program of the device as message receive confirmation, XBEE Communication for intranet connectivity with server and other devices and android app with real time update features from server.

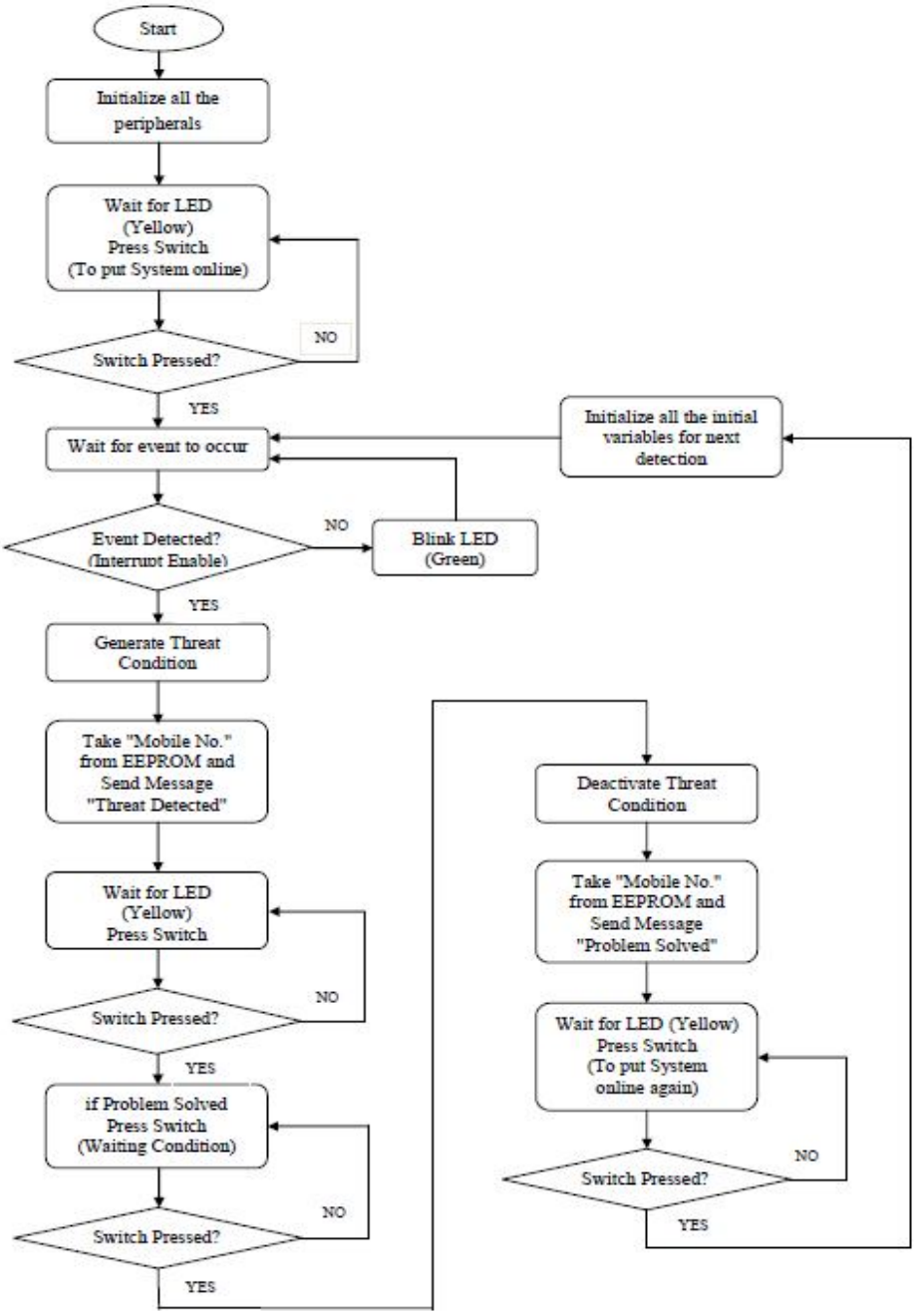

Fig. 3. Flow diagram of basic system

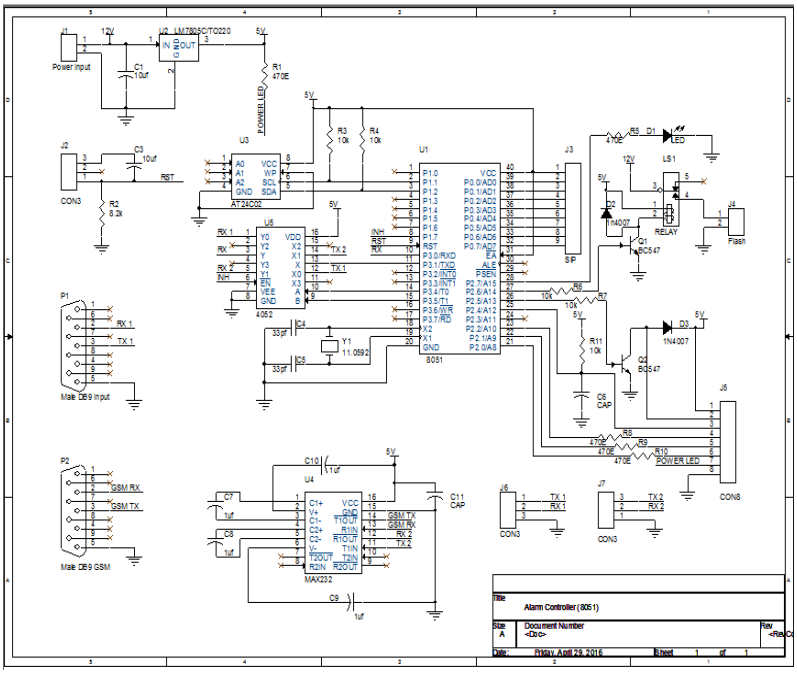

Fig. 4 Schematic diagram of system

Figure 4 show schematic diagram of main module corresponding to the device which contains microcontroller interfacing with EEROM, GSM, Flashlight and buzzer. The major problem of this device is to interface two different bidirectional serial communication modules with capability to communicate with microcontroller simultaneously. The solution to this problem is achieved with the help of IC-HCF4052B 4-channel analog multiplexer/demultiplexer. Other modules are also designed having XBEE communication device and battery charger and prevention circuits.

IV. RESULT AND DISCUSSION

For testing purpose some laboratory prototype has been developed. Each device is designed on two layers of modules. One module act as master module and other acts as slave module. Figure 5 shows two different microcontroller based alarm generator design approach. Master module is used to trigger audio visual alarm. For this purpose high power bulbs and speakers are connected with microcontroller with the help of relays. Relay isolates the low power microcontroller based circuit with high power audio video alarms. This module always keeps track of the triggering input. When even event occurs it generates alarm and pass an interrupt signal to other microcontroller (Slave). Other module generally stays in hibernation condition. But whenever it detect an interrupt signal from master module, it becomes active. On activation slave module first initialize XBEE and GSM Modules then starts to communicate with higher authority and nearest node about the event. Some predefined messages are used for communication.

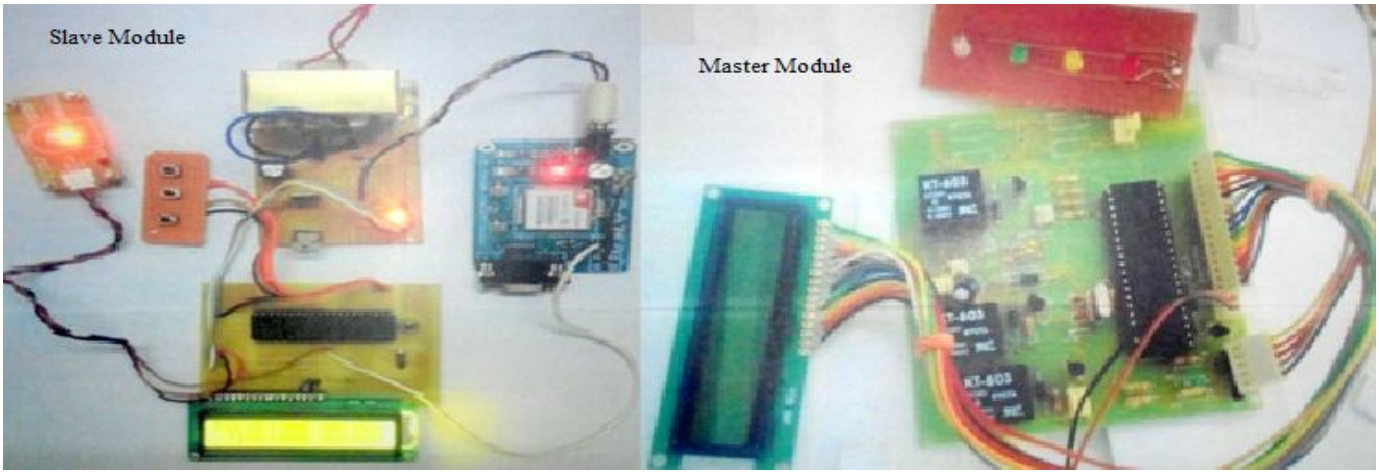

Fig.5 various electronic Modules

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Figure 6 represents a laboratory prototype of device which includes both electronic modules cover inside a box casing. Power and audio-video connector port are available on the back side of casing. DB-9 connector is also given for serial communication. Some general control switches and control LEDs are given on the top of the casing. Control LEDs are used to show event status, device health and program status of device.

Fig. 6 laboratory prototype

It is tested in offline and online mode. In offline mode alarm can be generated either via manual triggering switch or an external event signal. In online mode it can generate alarm via online server based triggering along with other two. Whenever device gets an external event triggering signal via serial communication or interrupt, it generates alarm. Devices have capability to talk with other devices in case of mass alarm generation. In online mode, if a particular device is not responding to the event then that event is automatically gets transferred to nearby active system. Online server also tracks record of the SMS service delivery time with the help of master device. If the SMS is not delivered within specific time of 40 Seconds then too server automatically transfer command to nearby active system

The device is designed with modular concept. It can generate audio alarm, visual alarm, GSM based SMS alarm. If connected with server then it can also generate android application based PING alarm on application. If enabled by the user then server can generate call alarm to user in case of online system. Online system have capability to send any number of message either GSM or android application any number of time.

Generated alarm can be any of geographical area wise, priority wise or limited to particular persons. The system checks all its devices at start up unless it is manually deactivated at the time of implementation. At the start-up of every device, user has to configure the system about its health and peripherals. The device is easy to install and configure.

Advantages of presented device are its generic and modular design; it saves time and cost (NRE cost); it is a remotely controlled system along with online server connectivity. Technical advantage becomes major drawback of the system because in our country mobile infrastructure is not available everywhere as well as people are still uneducated and for this much large country having different geographical area, it is very hard to implement system on everyone's visual distance.

V. CONCLUSIONS

This paper shows a remotely controlled, low cost, secure, general purpose alarm controller and generator. A model of generic alarm controller unit is designed and tested. The presented system can be used in many applications such as- Intruder detection system, Electronic security system, Natural Disaster alarm system, Emergency alarm system, Society and personal safety alarm unit. If this system is implemented along with its online server and other IoT specification as discussed earlier, it can provide a feasible solution to real time thread detection and prevention. Further many more advancement as IoT based GPS, voice IC based audio alarm, online update server along with interconnected infrastructure and concern department integrated platform can give it another extends. On implementation and integration with various features as one click women safety, ambulance service and other emergency services it can make an extra mark along with its primary task of industrial and defense security.

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