

GSM Based Flexible Calling System For Coal Mining Workers

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Abstract-This paper presents an emergency flexible calling system consists of GSM module, solar panel, vibration sensor, battery sensor and fire sensor which are connected with centralized control room by wireless communication. Proposed system may be installed near coal mine where even basic emergency services are not available. It will be totally based on GSM signal strength. In case of medical & accidental emergency happen in the coal mine, particularly when the worker doesn't have the mobile phone or having no tower in coal mine, this system may be very much helpful. System has flexible timer for calling to the control room. The System will be protected from theft attempts using different alarm circuits like vibration sensor, fire sensor and battery sensor. This system will be continuously powered through a solar panel. This system will be useful even for illiterate people as well as for coal mining worker. The purpose of this project is to help people in emergency in remote location as early as possible. This system can useful in villages having no electricity.

Index Terms—Emergency calling system, Flexible timer ,GSM module, microcontroller, solar panel.

I. INTRODUCTION

In this system, strength of GSM network plays an important role. GSM module SIMCOM SIM 300 is used with microcontroller 8051. This project is provided with anti theft system. A battery of the project gets continuously supply from the solar panel.

This project is totally based on strength of GSM network. Flexible timer calling feature is added in this system for coal mining workers. Keypad is implemented in this system for getting desire time setting for emergency calling to the control room. Battery will be kept safe by providing battery sensor. In case of any short circuit, there will be a fire sensor

to alert the control room about this. If any thief try to steal this system by force, then there will be vibration sensor which will directly inform the control room about this attempt. Control room people can check the operation status of the system through a message response feature. Once the person from control room call on the system, then system automatically response it by sending message to him on mobile. Thus, we will come to know that system is working properly. For start up of any GSM module AT commands are necessary Programming of this system plays an important role. Programming is done in a "C" language with use of AT commands.

II. Hardware

A. GSM MODULE SIMCOM SIM 300

The GSM Modem supports popular "AT" command set so that users can develop applications quickly. The product has SIM Card holder to which activated SIM card is inserted for normal use. The power to this unit can be given from battery connected with solar panel to provide uninterrupted operation.



Fig.1 Image of GSM Module

This product provides great feasibility for devices in remote location to stay connected which otherwise would not have been possible where telephone lines do not exist. Its application areas are Mobile Transport vehicles, LAN based SMS servers, Alarm notification of critical events including Servers, Network Monitoring and SMS reporting, Data Transfer applications from remote locations, Monitor and control of Serial services through GSM Network, Integration to custom software for Warehouse, Stock, Production, Dispatch notification through SMS. The "AT" command set plays an important role for working of GSM module SIMCOM SIM 300. There are different commands in AT commands for calling as well as message. After typing "AT;", the module will start working. Then "ATD 9033xxxxxx;" command will directly call on number which we wrote with ATD command.

B. MICROCONTROLLER 8051

The 8051 is very useful in different applications. Many useful microcontrollers developed that based on and compatible with the 8051. Thus, the ability to program an 8051 is an important skill for anyone who plans to develop products that will take advantage of microcontrollers.

Special Function Register (SFR)

The 8051 is a useful microcontroller with a large number of modes of operations. Program may inspect and change operating mode of the 8051 by manipulating the values of the 8051's SFRs. If SFRs were normal Internal RAM, then they are accessed. The only difference is that SFR registers exist in the address range of 80h through FFh while internal RAM is from address 00h through 7Fh.

1) TMOD (Timer Mode, Addresses 89h): TMOD is useful for configure the mode of operation of timers. Using TMOD your program may configure each timer to be a 16-bit timer, an 8-bit auto reload timer, a 13-bit timer. Additionally, when an external pin is activated or to count "events" that are indicated on an external pin, then you may configure the timers to only count.

2) TL0/TH0 (Timer 0 Low/High, Addresses 8Ah/8Bh): These TL0/TH0, taken together, represent timer 0. Their behavior depends on how the timer is configured in the TMOD SFR; these timers always count up. It depends on what is configurable and when they increment in value.

3) TL1/TH1 (Timer 1 Low/High, Addresses 8Ch/8Dh): These two TL1/TH1, taken together, represent timer 1. Their exact behavior depends on how the timer is configured in the TMOD; however, these timers always going to count up. It depends on what is configurable and when they increment in value.

4) SCON (Serial Control, Addresses 98h, Bit-Addressable): This SFR is used to configure the behavior of the 8051's on-board serial port. It controls the baud rate of the serial port, whether the serial port is activated to receive data and also contains flags that are set when a byte is successfully sent.

5) SBUF (Serial Control, Addresses 99h): This SFR is used to send and receive data via the on-board serial port. If any value written to SBUF, it will be sent out to the serial port's TXD pin. Likewise, any value which the 8051 receives via the serial port's RXD pin, it will be delivered to the user program via SBUF. It serves as the output port when written to and as an input port when read from. The 8051 has two timers in which each function works the same way. One timer is TIMER0 and the other is TIMER1. The two timers share two SFRs (TMOD and TCON) which control the timers, and each timer also has two SFRs dedicated solely to itself (TH0/TL0 and TH1/TL1).

C. ASCII table

In a programming part ASCII table plays an important role. With a help of this table, we came to know different hexadecimal value of command like new line and carriage return. The hex value for new line feed is 'A'. The hex value for carriage return (:) is 'D'. Thus, for a programming part of microcontroller, it is necessary to write hexadecimal value with help of ASCII table.

D. Solar panel

An important part of the system will be solar panel. It will provide power supply to the battery. When charging of battery is going to finish, it will get continuous power supply from solar panel. There will be no effect of power failure in the villages on this system because this will be totally based on solar power. It will convert solar energy into electrical energy. Thus, it will provide continuous power supply to the emergency calling system. Solar panel will be implemented where sun light always easily available.

E. Anti-Theft system

1) Fire sensor: It will detect the fire in panel box of the project. Whenever short circuit happens in the panel box, sensor will detect this and send message to the control room. Then immediate action can be taken by control room.

2) Battery sensor: It will prevent battery by theft attempt. Whenever thief will try to open the door of panel box, sensor will detect this and it will give message to the control room. Thus, control room can alert the police about this incident.

3) Vibration sensor: Whenever a thief will try to steal the project with some force, vibration sensor will detect this and alert the control room about this incident. In the case of any vehicle knock down the system pole, then vibration sensor also alert the control room.

III. OPERATION



Fig.2 Components of the system

1) GSM module: This will provide a network to the project by use of antenna. LED will on after every 3 seconds if network is there. Module will be started by use of AT commands. Call and message can be done by this module. It will get continuous supply from battery. The GSM Modem supports popular "AT" command set so that users can develop applications quickly. The product has SIM Card holder to which activated SIM card is inserted for normal use.

2) Microcontroller 8051: For use of the 8051's on-board serial port, it is necessary to initialize the following SFRs: SCON, TCON, and TMOD. This is because the serial port is controlled by SCON. In this case by initializing TCON and TMOD, timer 1 will be configured.

3) Serial communication

One of the 8051's many powerful features is its integrated UART, otherwise known as a serial port. The fact that the 8051 has an integrated serial port means that you may very easily read and write values to the serial port. If it were not for the integrated serial port, writing a byte to a serial line would be a rather tedious process requiring turning on and off one of the I/O lines in rapid succession to properly "clock out" each individual bit, including start bits, stop bits, and parity bits.

It needs to configure the serial port's operation mode and baud rate. Once configured, write an SFR to write a value to the serial port or read the same SFR to read a value from the serial port. The 8051 will automatically let us know when it has finished sending the character we wrote and will also let us know whenever it has received a byte so that we can process it. We do not have to worry about transmission at the bit level which saves us quite a bit of coding and processing time.

The SCON SFR allows the configuration of the serial port. Thus, it will go through each bit and review its function. The first four bits (bits 4 through 7) are configuration bits. Bits SM0 and SM1 set the serial mode to a value between 0 and 3, inclusive. The four modes are defined in the chart immediately above. As you can see, selecting the Serial Mode selects the mode of operation (8-bit/9-bit, UART or Shift Register) and also determines how the baud rate will be calculated.

4) Battery: It will provide power supply to the GSM module. Battery is connected to solar panel for getting solar power whenever battery is low. With use of this our system will work on 24 hours. Battery will provide 12V supply to the GSM module SIMCOM SIM 300.

5) Solar panel: It will convert solar energy into electrical energy. It will provide 12V supply to the GSM module. So system will get continuous power supply at any remote location. It will mount on the same pole on which GSM module will be mounted.

6) Emergency switch: It will call the control room by pressing it once. So even illiterate person can use this system without difficulty which he will face in case of mobile phone. Once the button is pressed, green LED will on until call is on.

7) Timer keypad: By use of this, worker can fix the timer by pressing numbers from keypad. Timer calling will be set by this keypad.

IV. Working Flow Of System

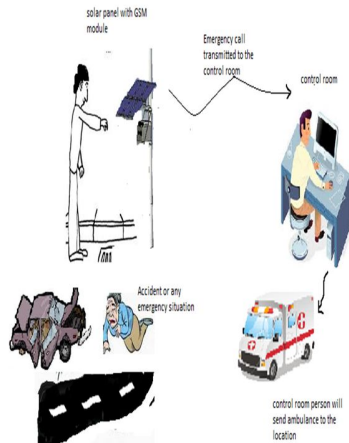


Fig. 3 Working Flow of system

Once the button is pressed, call will be directly connected to the control room. A person of the control room will listen the caller and according to it, he will call the police or fire brigade or an ambulance to help the people at that location. For coal mining worker, system has a flexible timer calling system. Suppose duty of a coal mining worker is of 8 hours. If he set the timer of 8 hours and he can't return in time due to an accident or fire in the coal mine, then call will connect to the control room after 8 hours indicating an emergency in coal mine. If worker return in time, he will press the button means call will not connect to the control room. During on time of period, an emergency takes place at same location like an car accident, then a person can also be able to call the control room during on time period of timer. For preventing theft attempt, anti theft system is included in the system. It will directly message the control room, if any thief try to steal it with some force or any car or animal got an accident with the system.

V. CONCLUSION

The purpose of this system is to help coal mining worker in emergency in coal mine as early as possible. Ongoing duty, worker set the timer of system, if worker can't return in time, then call from the system automatically connect to the control room indicating an emergency in coal mine. This system can be used by illiterate people and worker so this will be established between two villages having so much distance between villages. There will be no

effect of power failure in the villages on this system because this will be totally based on solar power. Once the person from control room call on the system, then system automatically response it by sending message to him on mobile. Thus, we will come to know that system is working properly. This concept will make system more reliable and useful. Additional safety features like battery sensor, fire sensor, vibration sensor can be implemented to prevent the system from possible theft attempts & fault conditions in the system. This system can also be implemented outside colleges for safety of girls. This system can also be implemented at sea port.

VI. REFERENCES

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