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Airport Automation using GSM

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ABSTRACT

Automation refers to "The Automatic controlling of a Task". Airport Automation deals with the Automatic controlling of tasks of the Airport like check in, security check , announcements , aircraft arrival and departure information , baggage control,.etc. This reduces the risk of manual errors during task execution , which may lead to accidents and delays at the Airport.

Keywords : - Automation, Airport, GSM, Control systems

I. INTRODUCTION

Aircraft is the best means for traveling far off distances by many passengers to other countries or continents. Airport is the base station for the passengers from where they will travel to their respective destinations. Till now the Airport tasks was controlled manually by humans [1]. That is, one section of Airport would be set to control the landing and take off of the Aircraft's, one section for security check, one more section for weather checking, other section for controlling the check-in and check-out of the passenger's at the Airport. Due to such manual controlling many error occur, resulting in delay, which could cause the runway unsafe for landing [2]. Their would be lot of delay in security checking counter's as well.This is all about manual controlling of different tasks of airport separately, which may lead to several accidents , insecurity of passengers at the airport [3].

II. OUR CONTRIBUTION

As a major step to prevent the confusions, and accident at the Airport , we are introducing a prototype model, which tells about automatic controlling of tasks. Here we use 89c51 microcontroller , member of intel 8051 family. The special feature of microcontroller is that , it can perform 'n' number of tasks at a time simultaneously with out much delay.

We use GSM technology, for communicating with the pilot's of aircraft. Before take off of aircraft to its destination's base station, a message is send to destination's base station by pilot regarding flight details [4]. Immediately after receiving message, the weather sensor would be made ON for checking weather and checks the runway for clearance , if every thing

is good, a message is sent automatically to pilot to take off and reach to its destination. When the aircraft approaches near airport, with the help FM receiver the aircraft is detected and automatically announcement is made at the airport regarding arrival of flight. When aircraft lands at the runway , another announcement is made automatically regarding the flights arrival at respective terminal number when it has arrived. Automatically with the help of conveyer, the baggage's of all passengers are directly are sent to the security checking centre from Aircraft itself. Passengers need not have to bother about their luggages because after checking it in the entrance, the baggages will be taken care of till the destination [5].This is a prototype model describes an integrated system room where baggage handling, apron handling, security, ground handling, take off and landing controlling and immigration will operate together.

III. BLOCK DIAGRAM AND FUNCTIONAL DESCRIPTION

GSM stands for Global System for Mobile Communication. This is a worldwide standard for digital cellular telephony, or as most people know them Digital Mobile Telephones [6]. In addition to digital transmission, GSM incorporates many advanced services and features, including ISDN compatibility and worldwide roaming in other GSM networks. The advanced services and architecture of GSM have made it a model for future third-generation cellular systems, such as UMTS. GSM was designed having interoperability with ISDN in mind, and the services provided by GSM are a subset of the standard ISDN services. Speech is the most basic, and most important teleservice provided by GSM [7]. In addition, various data services are supported, with user bit rates up to 9600 bps. Specially equipped GSM terminals can connect with PSTN, ISDN, Packet Switched and Circuit Switched Public Data Net-works, through several possible methods, using synchronous or asynchronous transmission. Also supported are Group 3 facsimile services, videotex, and teletex. Other GSM services include a cell broadcast service, where messages such as traffic

reports, are broadcast to users in particular cells. A service unique to GSM, the Short Message Service, allows users to send and receive point-to-point alphanumeric messages up to a few tens of bytes. It is similar to paging services, but much more comprehensive, allowing bi-directional messages, store-and-forward delivery, and acknowledgement of successful delivery [8].

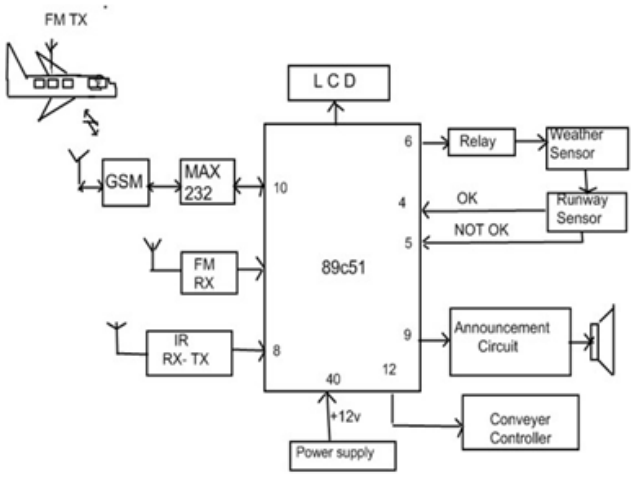

Fig. 1. Block Diagram of Airport Automation

B. GSM Frequencies

In principle the GSM system can be implemented in any frequency Band. GSM frequency bands are the radio frequen-cies designated by the ITU for the operation of the GSM for phones. However there are several Bands as shown in table I. Where the GSM terminals are or will shortly be available. GSM terminals may incorporate one or more of the GSM technology bands listed below to facilitate roaming on a global basis. There are fourteen bands defined in 3GPP TS 45.005, which succeeded 3GPP TS 05.05 [11].

TABLE I. STANDARD GSM FREQUENCIES [12]

System	Band	Uplink(MHz)	Downlink (MHz)	Channel Number
GSM-450	450	450.4–457.6	460.4–467.6	259–293
GSM-480	480	478.8–486.0	488.8–496.0	306–340
GSM-750	750	747.0–762.0	777.0–792.0	438–511
GSM-850	850	824.0–849.0	869.0–894.0	128–251
GSM-900	900	880.0–915.0	925.0–960.0	975–1023, 0-124

C. GSM Modem

GSM MODEM provides full functions capability to serial devices to send SMS and data over GSM network . The most familiar modem is the one that we use for browsing Internet. The conventional modem has two connection ends and both the connections are wired. One end is connected to the com-puter and the other end is connected to the telephone line. The serial port of the computer (of RS-232 standards) is connected to the modem while the other end of the modem is connected to the telephone line and the modem effects the two-way data communication. The GSM modem is slightly different from the conventional modem. This utilizes the GSM standard for cellular technology. The GSM modem acts like a cellular phone and transmits text and voice data. It communicates with the GSM network via the SIM (Subscriber's Identity Module) card. We use the Nokia 1110 mobile phone in place of this modem for interfacing with the microcontroller via the data cable.

The AT commands are used to control the operation of the modem. They are called AT commands because the characters AT must precede each command to get the ATtention of the modem. AT commands can be issued only when the modem is in command mode or online command mode [13]. The modem is in command mode whenever it is not connected to another modem. The modem is in data mode whenever it is connected to another modem and ready to exchange data. Online command mode is a temporary state in which one can issue commands to the modem while connected to another modem. To put the modem into online command mode from data mode, we must issue an escape sequence (+++) followed immediately by the AT characters and the command, e.g., +++ to hang up the modem. To return to data mode from online command mode, we must issue the command ATO. To send AT commands to the modem we must use a communications program, such as the HyperTerminal applet in Windows 98/95 and NT 4.0, or some other available terminal program. We can issue commands to the modem either directly, by typing them in the terminal window of the communications program, or indirectly, by configuring the operating system or com-munications program to send the commands automatically. Fortunately, communications programs make daily operation of modems effortless by hiding the commands from the user. Most users, therefore, need to use AT commands only when reconfiguring the modem, e.g., to turn auto answer on or off. The format for entering an AT command is ATXn, where X is the command and n is the specific value for the command, sometimes called the command parameter. The value is always a number. If the value is zero, it can be omitted from the command. Most commands have a default value, which is the value that is set at the factory. One must press ENTER (depending on the terminal program it could be some other key) to send the command to the modem. Any time the modem receives a command it sends a response known as a result code. The most common result codes are OK, ERROR, and the CONNECT messages that the modem sends to the computer when it is connecting to another modem. Several commands can be issued in one line, in what is called a command string. The command string begins with AT and ends when ENTER is pressed. Spaces to separate the commands are optional; the command interpreter ignores them. The most familiar command string is the initialization string, which is used to configure the modem when it is turned on or reset, or when the communications software calls another modem. The AT commands used by us for the purpose of sending messages through the GSM modem, are AT+CMGF

and AT+CMGS. Issuing the AT+CMGF helps in setting its mode (PDU or text). Its syntax is AT+CMGF = [¡mode¿] Issuing the AT+CMGS command, the GSM modem will send an SMS to the mobile number that is sent as a parameter in the AT command. Its syntax is AT+CMGS = ¡phone number¿¡CR¿ message ¡Ctrl+Z¿.

D. AT89C51 Microcontroller

The AT89C51 is a low-power, high-performance CMOS 8-bit microcomputer with 4K bytes of Flash programmable and erasable read only memory (PEROM). The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard MCS-51 instruction set and pinout. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with Flash on a monolithic chip, the Atmel AT89C51 is a powerful microcomputer which provides a highly-flexible and cost-effective solution to many embedded control applications [14].

The AT89C51 provides the following standard features: 4K bytes of Flash, 128 bytes of RAM, 32 I/O lines, two 16-bit timer/counters, a five vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator and clock circuitry. In addition, the AT89C51 is designed with static logic for

operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator disabling all other chip functions until the next hardware reset.

E. FM Receiver and Transmitter

The FM transmitter is working on 27 Mhz is used to control the relay .It based on DTMF (dual tone multi frequency). The DTMF generate IC no 91214 various types of 16 tones the tones are modulated in modulator section after amplification by the RF section is radiated by the antenna Transistor BC 494 are used for RF amp and modulator .Rod antenna is used to transmit the FM modulated signal because the impedance of the circuit and the antenna are same 75 ohm.

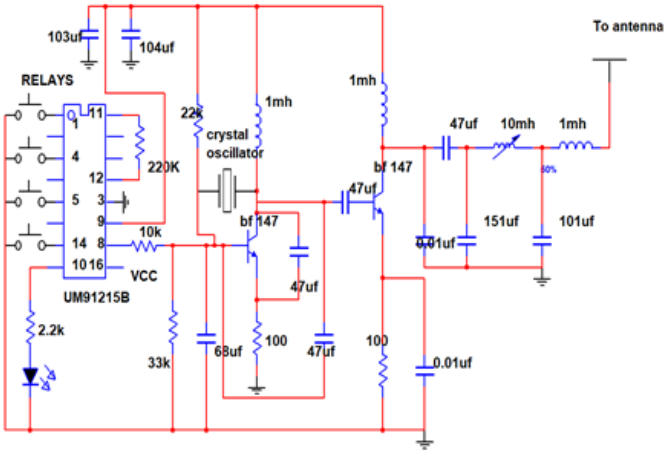

Fig. 2. FM Transmitter

The signal transmitted is received by the Receiver an-ntena.The length of the anntena is reduced by the connecting the inductor in series with the antenna.Its then fed to the RF amplifier to amplify the received signal since received signal strenght is low. An inductor is connected at the collector and tuned to the carier frequency used to the transmitter for synchronization the receiver and tranmsitter frequency .Frequency modulated signal is obtained at the collector. The signal is then demodulated by passing it through diode, which removes the carier signal and hence signal obtained at the output of the diode is a DTMF signal.Which is then passed to the DTMF decoder to Deocode the signal sent and hence run the relay and inturn controlls in which direction should the 12V DC motor rotate depending on the signal transmiited from the receiver section.

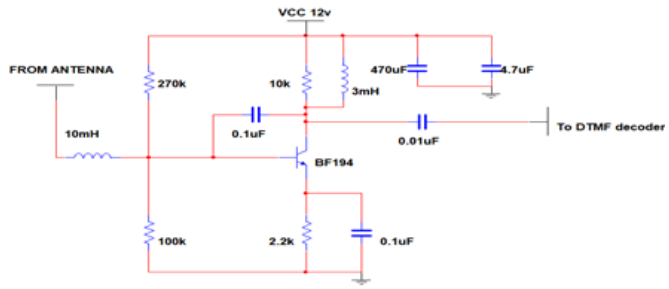

Fig. 3. FM Receiver

F. Announcement Circuit

The APR9600 device offers true single-chip voice record-ing, non-volatile storage, and playback capability for 40 to 60 seconds. The device supports both random and sequential access of multiple messages. Sample rates are user-selectable, allowing designers to customize their design for unique quality and storage time needs. Integrated output amplifier, micro-phone amplifier, and AGC circuits greatly simplify system design [15].

The device is ideal for use in portable voice recorders, toys, and many other consumer and industrial applications.APLUS integrated achieves these high levels of storage capability by using its proprietary analog/multilevel storage technology implemented in an advanced Flash non-volatile memory pro-cess, where each memory cell can store 256 voltage levels. This technology enables the APR9600 device to reproduce voice signals in their natural form. It eliminates the need for encoding and compression, which often introduce distortion. The APR9600 device incorporates several features designed to help simplify microprocessor controlled message management. When controlling messages the microprocessor essentially toggles pins as described in the message management sections describe previously. The Busy,Strobe, and M7END pins are included to simplify handshaking between the microprocessor and the APR9600 The /Busy pin when low indicates to the host processor that the device is busy and that no commands can be currently accepted. When this pin is high the device is ready to accept and execute commands from the host.

The APR9600 samples incoming voice signals and stores the instantaneous voltage samples in non-volatile FLASH memory cells. Each memory cell can support voltage ranges from 0 to 256 levels. These 256 discrete voltage levels are the equivalent of 8-bit (28=256) binary encoded values. During playback the stored signals are retrieved from memory, smoothed to form a continuous signal, and then amplified before being fed to an external speaker.

According to the Shannon's sampling theorem, the highest possible frequency component introduced to the input of a sampling system must be equal to or less than half the sampling frequency if aliasing errors are to be eliminated. The APR9600 automatically filters its input, based on the selected sampling frequency, to meet this requirement. Higher sampling rates increase the bandwidth and hence the voice quality, but they also use more memory cells for the same length of recording time. Lower sampling rates use fewer memory cells and effectively increase the duration capabilities of the device, but they also reduce incoming signal bandwidth. The APR9600 accommodates sampling rates as high as 8 kHz and as low a 4 kHz. You can control the quality/duration trade off by controlling the sampling frequency. An internal oscillator provides the APR 9600 sampling clock. Oscillator frequency can be changed by changing the resistance from the OscR pin to GND. Table 2 summarizes resistance values and the corresponding sampling frequencies, as well as the resulting input bandwidth and duration.

TABLE II. STANDARD GSM FREQUENCIES

Ref Rosc	Sampling Frequency	input Bandwidth	Duration
84K	4.2 KHz	2.1 KHz	60 sec
38K	6.4 KHz	3.2 KHz	40 sec
24K	8 KHz	4.0 KHz	32 sec

G. Firmware Development

The firmware for the airport automation system was de-veloped using Keil software. The process flow chart below describes the step by step execution of the automated system. The prototype testing of the system yielded better response.

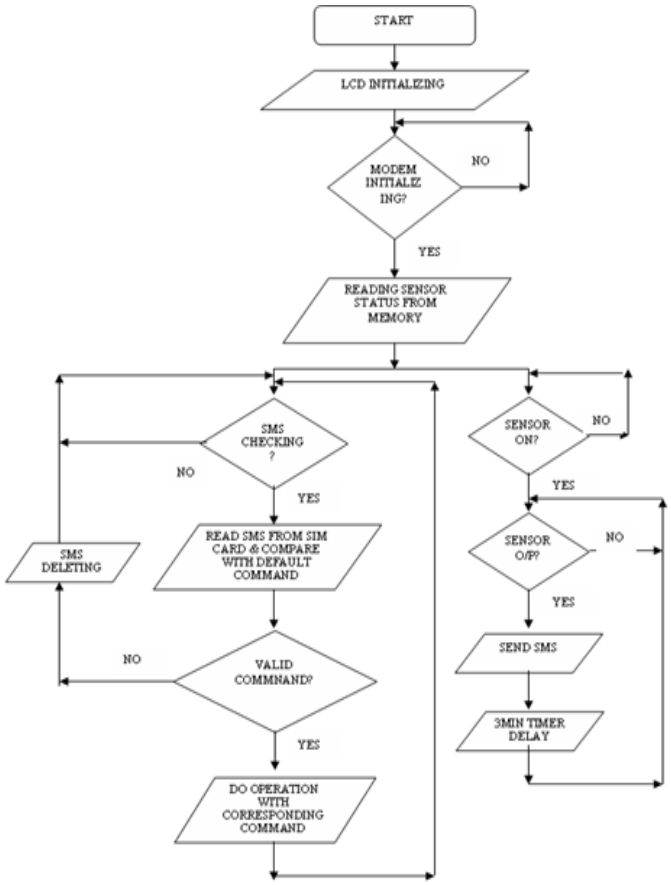

Fig. 4. Firmware Development

IV. CONCLUSION AND FUTURE SCOPE

This project is an attempt to present a prototype model which can operate automatically with minimum human inter-vention. It also capable of collecting the data from the pilot of planes and communicate simultaneously with help of GSM. The GSM will also be able to send the encrypted messages about safe landing of the airplane. The GSM device helps in sending the SMS message via the GSM network.This project also tries to present a prototype model which is cost effective and versatile in its work and function compared to the present airports.

The cost effective objective can be realized by the careful selection of components, which in the project has been suc-cessfully implemented . This prototype model can be used to reduce human risk operations in place of man-machine monitoring for service which is hazardous.

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