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Long Distance Wireless Monitoring Security House System

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ABSTRACT

The improvement of utilization wireless systems in the technology of security and automation such as security house system, wireless communications, productions monitoring process and wireless sensor applications have contributed a large transformation in Global Mobile Communication System (GSM) recently. It is very silent in facilitating and enhancing better performance both in the industry and our daily lives. This paper presents a wireless monitor and control alarm system based on GSM. This system uses microcontroller AT89C51 as the MCU, infrared sensor and a PIR sensor (SN-PIR) to sense the human movement at living room. The operation of proposed system is more efficient and accurate in long distance monitoring by using GSM as a wireless devices from the conventional or alarm system. System design was tested at the room and the data analysis for time response and efficiency of sensor used has being taken. The testing result show that the distances for data sending are more widely and fasting response in any sensor are triggering.

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INTRODUCTION

Global mobile communication system (GSM) has been widely used in telecommunication system. In domestic environment the security house system is used to improve the quality of resident's life (Sheikh Izzal Azid, 2011). A lot of methods are used in wireless technology in automation house system and it includes the Bluetooth, XBee, Wi-Fi and Global mobile communication system (GSM) application(Y. Tajika 2003, K. Gill 2009, M. H. Jin 2008, L. Ophir 2004, B. Yuksekkaya 2006). The system that used MMS for picture sending for security house system is effective but it could be problems when the 3G, 2G or GPRS for mobile phone not activate and it take a time for picture sending (M.H. Husina 2012, Zhijie Tang 2011). Other than home security system, GSM is also used to turn the street lights. This is based on the use of the RTC to determine the condition of the daylight or night for street lighting (N. Nithyaa 2012). With the implementation a Controlled Integrated Home System by using Global System Mobile (GSM), GSM technology capable solution has proved to be controlled remotely, provide home security and is cost-effective.

Thus this paper presents the application of GSM in security house system known as long distance wireless monitoring security house system to overcome the existing application and interfacing in security house system such as wide range and efficient of sensor used. This problem is solved by using the digital IR sensor, PIR sensor, LDR sensor and backup supply in system's proposed. Other advantage of the system proposed is fasting signal sending by using digital sensor and the correct SMS receive.

2. Methodology:

Structure basic working of system consist four stages generally as shown in Fig 1

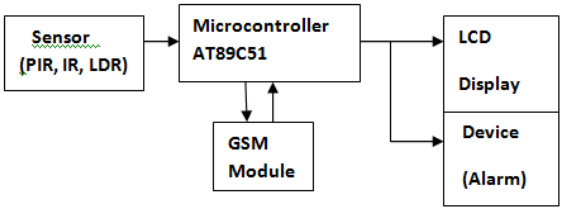

Fig. 1: General Block Diagram

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The intrusion detector is a Passive Infra-Red sensor (PIR) it functions for measuring change of human movement. This motion can detect by checking for a high signal on a single I/O pin, and another intrusion detector is Digital Infrared to detect any obstacle in front of sensor NPN output infrared sensor that up to 30cm sensing distance. There two elements are fixed across the window/door and send on/off signal in case of intrusion. The sensor will be connected to the microcontroller and acts as a switch. The microcontroller controls the whole system. It collects information from sensors and makes a decision and sends SMS to a corresponding number by using GSM module. If it finds any interruption in its sensors like if the PIR or Digital Infrared Sensor is interrupt microcontroller will send a SMS to home owner and alarm is on. The communication between microcontroller and GSM module through serial communication and microcontroller only accept the AT command to control the whole system. Any signal from the sensor will be sending to microcontroller for processing and the output action are responses for display and warning for unusually detection when the system being activate.

3. Software AT Command (Attention command):

AT commands (Attention commands) are commands that control the Controlled Integrated Home System. The AT commands can be representations of the protocol are used by microcontroller AT89C51 before sending or read message from GSM in fig 2. The communication between GSM and AT89C51 are through the serial RS232. The step for sending data form microcontroller AT89C51 are, first the microcontroller sends the first character of the AT Commands to the mobile. Then the microcontroller will wait for the mobile phone to resend the same character to prevent the collision between the transmitted and received signal at the SBUF (Serial Control, Addresses 99h). The microcontroller will send the remaining character by the same way. Once the AT Command has been send completely, the mobile phone will send a response to the microcontroller. The number of the character response will vary from AT Command to other. The microcontroller must wait until the received response finish completely. The basic communication protocol between AT89C51 and GSM can be representing as Fig 3.

- AT<enter>/* this command is used to check communication between the module and the computer Ok/* The command returns a result code OK if the computer (serial port) and module are connected properly. If not working it would return a result code ERROR.
- AT+CMGF=1<enter>/* this command is used for text mode
- AT+CMGS=<012345678><enter>/* this command is used to send a SMS message to a phone number. The modem will respond with' >'
  Reply: >
- Type the message and send the message using the <CTRL+Z> key. Hello World! <CTRL+Z>

Fig 2: Step for AT command

4. Other AT Commands that are related to the SMS message

- AT+CMGF=1/* Setting the message format to the text mode.
- AT+CSDH=1/* Setting the AT command to the mode that allow sending SMS.
- AT+CSMP=17,167,0,0/* Setting the text mode parameter, where the second parameter specifies the period for resending, meaning that 167 specifies that the time is 24 hours. The other parameters are related to the coding protocols.
- AT+CPMS=<mem1>, <mem2>, <mem3>/* Preferring the memory location for the message storage. <mem> is represents the type of memory to be used either SIM card or mobile equipment, which are indicated by SM or ME respectively. Mem1 specifies the memory from which the message will be read and deleted. Mem2 specifies the memory to which writing and sending operation made. Mem3 specifies the memory that the received message will be stored in it.
- AT+CMGR=1/*Reading the message, where "1" is the number of the message in the memory.
- AT+CMGS="the phone number"/*Sending the message.
- AT+CMGD=1/*Deleting the message.

Fig. 3: Step for send and read message

5. Hardware for GSM Module (Siemens TC35):

Fig 4 shows the GSM module device. It focus more on SMS as a command code for implement something action from GSM signal and will process from microcontroller. Transmission data from GSM to cell phone must though AT command code. This GSM Development Board use Siemens TC35 GSM module as the wireless communication unit.

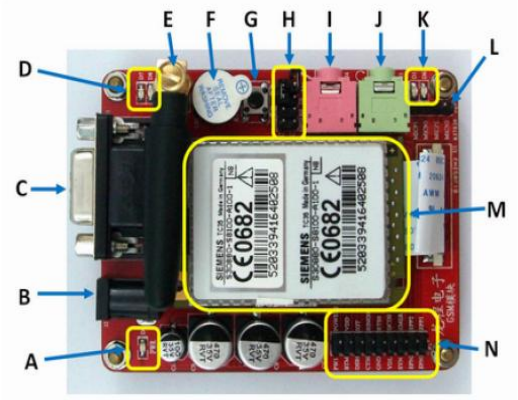

Fig. 4: GSM module device

6. Microcontroller:

The microcontroller is a programmable device that acts as the brain of the system. Microcontroller is designed to be multiple input and output. To make this microcontroller works the basic operation circuit should being developed for AT89C51.Second step is the program writing. The program language was used is assembly language (ASM). This program writing should be written in Keil uVersion software. This software could be checking for syntax error from program writing. After that the program should be compiling to get the hex file before transfer to AT89C51. Hex file or machine code is important code that used at microcontroller to control the process by according user need. The AT89C51 is a low-power; high performance CMOS 8-bit microcomputer with 8K bytes of Flash programmable and erasable read only memory technology. Fig 5 show the basic microcontroller circuit.

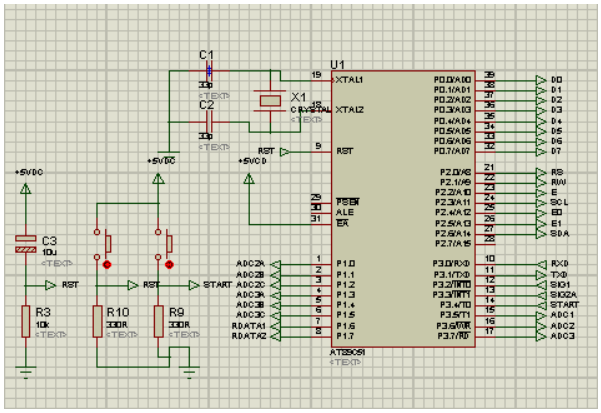

Fig. 5: Basic Microcontroller Circuit

7. Infrared and PIR sensor:

Infrared sensor used is purpose NPN output infrared sensor that up to 30cm sensing distance. It can be use at automation machine, mobile robot for obstacle detecting it is a non-contact detection. The implementations of modulated IR signal immune the sensor to the interferences caused by the normal light of a light bulb or the sun light. The infrared sensor can sense object are crossing the line signal from transmitter IR and the signal will receive of IR receiver. The concept are used of IR sensor is reflection. The IR sensor connection should through the opt isolator circuit before connect to AT89C51. It's because of operating supply IR sensor is used the 12VDC, whereas the AT89C51 only used 5VDC for operating supply. The infrared sensor could sensing the signal range of approximately 3cm to 80cm and the sensing distance can adjusted manually. Figure 6 show the circuit for infrared sensor and PIR sensor.

Passive Infra-Red (PIR) sensor, it functions for measuring change of movement. This motion can detect by checking for a high signal on a single I/O pin. Usually used as a security device in a monitored area (such as a room or hall) to detect appearance of human. Rating for operating power supply is +4.5V-+5.5V, while rating for

operating temperature is -15°C-+70°C. The sensor is designed to adjust to slowly changing conditions that would happen normally as the day progresses and the environmental condition change, but responds by making its output high when sudden change occur. PIR sensor is connecting directly with AT89C51 and it shown in Fig 6.

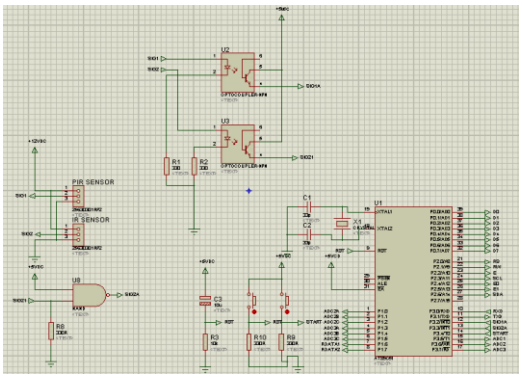

Fig. 6: Infrared and PIR sensor circuit

8. Main Circuit:

The main circuit in this project is show in fig 7. GSM is wireless device that capability to sending and receiving data to microcontroller. To operate the GSM, logic converter is the important component. The main purpose of logic converter is to converted 3.3VDC to 5VDC. Microcontroller is a main component in this circuit that function to control the device including sensors, GSM and LCD. Light dependent resistor or (LDR) is operating as a sensor to recognize the dim and bright of room. LDR sensor will operated once the condition of room is dark and the high signal from LDR sensor will be sending the signal to microcontroller AT89C51. From here the AT89C51output pin will send the signal to energize the coil relay to active the lamp. The Liquid cathode display (LCD) is function to display the status or condition of the system. The siren is 1 of output that used as indicator when intruder was intruding the house. The siren connection is through the relay because the voltage supply are used is 240VAC. The output signal is come from AT89C51 as microcontroller.

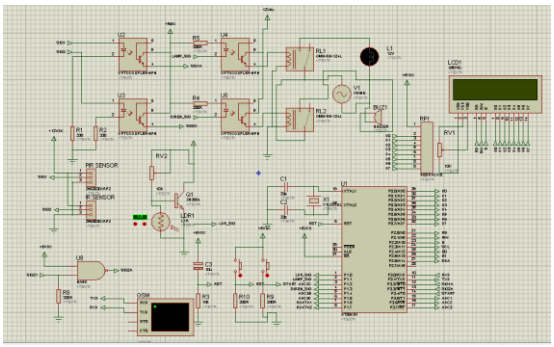

Fig. 7: Main circuit

9. Experiment Setup (Project Concept):

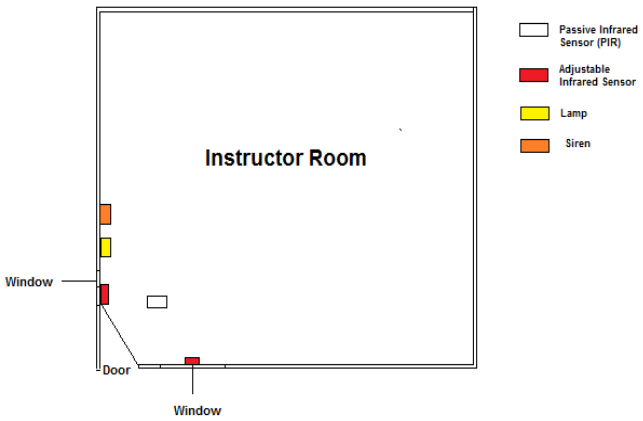

Fig. 8: Top Plan View

The top plan view in home for sensor installation is show in fig 8. There are three type of sensor were applied in this system. First type is Adjustable Infrared Sensor (IR). The second type is Passive Infrared Sensor (PIR) and lastly Light Dependent Resistor (LDR). For the first Digital Infrared Sensor will be installed on each window to detect any illegal intrusion. PIR Sensor used to detect human movement. This sensor will installed on ceiling at height on 7 to 9 feet by functioning to detect any unusual movement, if the sensor detect human movement the alarm will on and GSM will sending the SMS to home owner. The LDR is functioning to check the condition room and the lighting is on if the room in deem surrounding. The fig 9 represents the level of the control circuit box positioning sensor in the room setup. This is dividing by three levels. For the first level has located switching power supply 12Vdc, potentiometer, ON-OFF switch battery 12v and electrical relay. For second level that is, locate the main circuit and voltage regulator circuit. For the third level, represent the TC35 GSM development board, reset pushbutton and LCD.

Fig. 9: Project picture

10. Flow Chart of the system:

Fully operation system will be explained by following flow chart in fig 10. When system being activate, the first message will be sending to owner for identification for this system. The message will be receive is "SYSTEM ACTIVATE". From here all connected sensors are in active condition. If no intruder are detecting, the condition of surrounding being check for on or off the internal lighting. If intruder are detecting, the external siren will on for warning or notify neighbors that there is something happening at the owner residence. At the same time, the SMS will be sending to owner for commemorative home invaded. From here the owner or used should reply the SMS for second action response at the system. The second response being take of the system with sending the SMS to neighbor, close relatives or the nearest police station for further action.

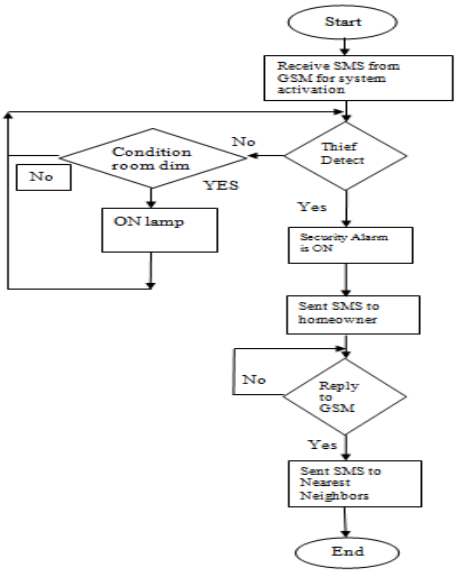

Fig. 10: Flow Chart of the system

RESULT AND DISCUSSION

Table 1 show the time taking for Short Message System (SMS) data sending and receiving in difference place or distance. The range of distance is taken between 27km to 430km from the system setup. Based on Table 1, the increase in the distance between system setup and the recipient will increase the time for the recipient. The graph in fig 11 show how the distances for message receive will be effect on the times. From here, the message will be receive in 1 second when system is triggering in range distance 27 km to 63 km and will be increase to 2s, 3s and 4s when the distance is increasing from 77km until 280km. The constant time for message sending and receive will be taken in 4 second for distance 280km to 310 km.

Table. 1: Time Duration for Sending and Receiving SMS in difference location

Distance (KM)	Sending time message (24 hour)	Receiving time message (24 hour)	Time taken/sec (receiving time message – sending time message)
27	17:31:00	17:31:01	1
39	18:00:00	18:00:01	1
63	18:31:04	18:31:05	1
77	19:00:10	19:00:12	2
140	19:31:05	19:31:08	3
280	20:00:00	20:00:04	4
310	20:31:20	20:31:24	4
317	21:35:10	21:35:15	5
430	21:00:14	21:00:19	5

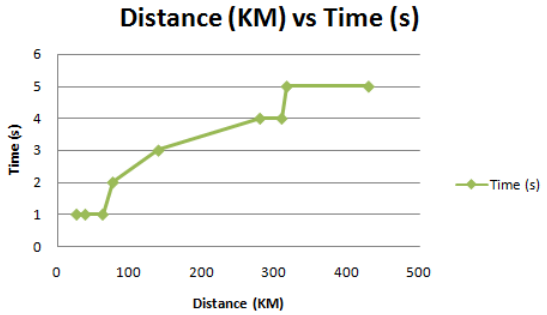

Fig. 11: Graph distance vs time taken

Access to the PIR sensor angle plays an important role by based on the data in table 2. The angle covered for PIR sensor is between 0 ˚ to 120˚. By following the graph in fig 12, the maximum of the distance can be detected is 500 cm in angle of sensor is 60˚. The lower distance detected for PIR sensor is in 0˚ by 65cm and in angle 140 until 160 the PIR is fail in sense the movement.

Table 2: Limitation of PIR

Angle (Degrees)	Distance (cm)	Alarm
0	65	Trigger
20	140	Trigger
40	220	Trigger
60	500	Trigger
80	140	Trigger
100	220	Trigger
120	450	Trigger
140	0	Not Trigger
160	0	Not Trigger

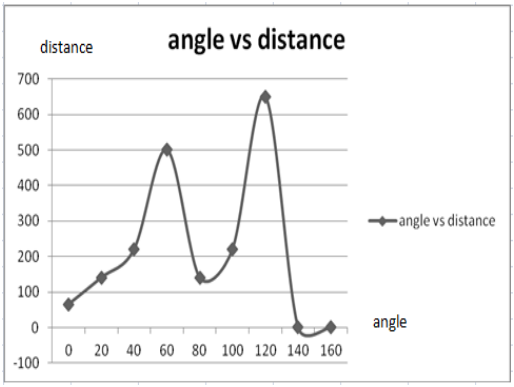

Fig. 12: Graph angle vs distance

Conclusion:

This paper are focusing the implementation of GSM devices and the time response are taking for, besides the efficiency of PIR sensor in angle detection by base on the distance. This constrain has been overcome by the long distance wireless security house system. The performance of system purpose was proved and analyzed to be reliable. The application of this system is appropriate at house or warehouse protecting. The detection aspects can vary according to the current requirements of the GSM system. It offers long distance monitoring and efficient in message sending by GSM module.

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