

A NEW INVENTION OF ALARM REMINDER LOCKING (ARL) SECURITY SYSTEM

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Abstract—Alarm Reminder Locking (ARL) Security System mainly focuses on a door security system, which can install in the door area to increase the security level for home, office room, hostel or other places. This system used Arduino Controller and Global System for Mobile Communication (GSM) technology, which is the cheapest source to embed the security system to transmit the Short Message Service (SMS) alert data. This device integrates three functions that are alarming, reminder and locked for a purpose of safety and connecting via mobile phone to remind the users through SMS. This device has a 3 modes of operation which is the system will be functional when the door is not improperly closed for the first reminder with the buzzer alert. The second mode is automated locked will be activated when users closed the door, but did not lock manually. Intrusion mode will activate while auto locked modes are interrupted without proper access. All this integrated system will provide high security access against intrusion occurrence. This security device will bring a new benefit to the user to consider about the user-friendly application, low power consumption and reasonable cost to install.

Keyword- Global System for Mobile Communications (GSM), Home security system, Short Message Service (SMS)

I. INTRODUCTION

The Alarm Reminder and Locking (ARL) Security System is an innovative electronic device installed in the door area to protect the room from any situation such as burglary. The objective of this design is to increase the security level to secure valuable documents and items by implementing an existing mobile network technology which is cheaper and low power consumption device that will useful to the users. This device applying Global System for Mobile communication (GSM) and Short Message Service (SMS) technology to ensure the device system will operate directly to the users through their mobile phone. The system used Arduino Uno R3 controller embedded with GSM/GPRS SIM 900 shield to activate all components that are alarming busier, solenoid for locking and magnetic door sensor for a purpose of the security method. The ARL Security system working in three different situations that is improper door closed, automatic locking and intrusion occurrence and due to this matter, it able to perform only in one application system. Some of the improvement has been developed to enhance the capability of this system to overcome the problem when an intrusion occurs. When someone enters the room and the system still in locks mode, the device will automatically activated because of the magnetic door sensor is reacted. The system will trigger the alarm buzzer to emit the warning sound and at the same time, the GSM will transmit the caution data through SMS to inform and remind the user about that situation.

II. LITERATURE REVIEW

Kunal Maurya et. al. [1] proposed an Anti-theft Tracking System embedded in Global System for Mobile communication (GSM) and Global Positioning System (GPS) technology for tracking and positioning of any vehicle to prevent it from being stolen. It used AT89C51 microcontroller to interface with a GSM modem and GPS receiver that will continually monitor and report the position of the vehicle. The function of GSM modem is to send the longitude and latitude to signify the location of the vehicle. On the other hand, the GPS modem function is to give the parameter output and National Marine Electronics Association (NMEA) protocol format data will sending out the information on the position of the vehicle to the user mobile to inform the position of the vehicle. The block diagram of tracking system as shown in Figure 1, was designed to present the process of

GSM modem and GPS receiver integrated with microcontroller to ensure the vehicle will locate around the world.

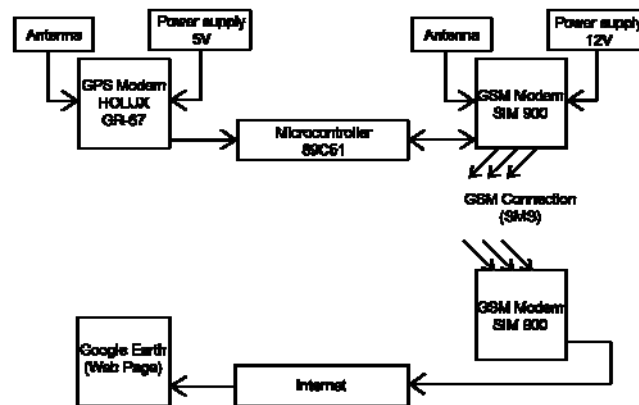


Fig. 1. Block diagram illustrating the concept of Anti-theft Tracking System [1]

The data taken from the GPS receiver will be sent to the user in the form of SMS using GSM modem. The GPS receiver will retrieve only the \$GPRMC data values from the different satellite, then the latitude and longitude data will be sent to the microcontroller AT89C51. AT89C51 will process the data and then deliver to the GSM modem. This integrated system supplied by battery power which GSM required 12V and GPS and microcontroller requires 5V with regulator. In further development, this system will integrate with sensor to report the vehicle information to the server to see and save the route and also others information on the computer [1].

Malik Sikandar Hayat Khiyal et. al. [2] developed SMS Based Wireless Home Appliance Control System (HACS) for Automating Appliances and Security which offered a lower price, auto-configurable and remotely controlled. This system was applied short Message Service (SMS), Global System for Mobile communication (GSM), Radio Frequency (RF), AT Commands, ubiquitous access and automation technology to ensure the system provides an effective function requirement to the users. This system enabled the user to monitor directly through SMS to perform the control system. This automatic system using GSM modem is directed monitoring by the user through their SMS to perform the control system. Further development will implement an others integration detection system using automatic motion/glass breaking detectors that generate SMS automatically send to the users to ensure an appliances are monitored and to recognize an emergency situation such as gas leakage, smoke or fire.

Delgado et. al. [3] discussed the problems about the applying of home automation systems with different network technologies. A few issues have been carried out during the investigation, which are a lack of robustness, compatibility and acceptability among the old and disability people.

Ciubotaru-Petrescu et.al. [4] proposed a new design of SMS based control for monitoring systems. The system have been separated into three modules which is microcontroller, General Packet Radio Service (GPRS) modem and cell phone via serial port RS-232. The Short Message Service (SMS) has been used for reporting a status, such as power failure.

Conte et. al. [5] proposed a new home automation system as a multiple agent system (MAS) to control and maintained home appliances and devices to improve the performance.

Alkar et. al. [6] proposed a low cost and flexible web-based solution of an Internet Based Wireless Home Automation System for Multifunctional Devices. This device has a some boundary such as the range and power failure.

Murthy [7] discovered about the use of mobile web-technologies such as the Short Message Service (SMS), cell phone technology, transnational exchange and personal communication to manage the Primary Healthcare (PHC) for the rural population.

Jawarkar et. al. [8] designed a remote monitoring through a mobile phone connected with spoken commands that can be generated and sent a Short Message Service (SMS) to the control system embedded with a microcontroller to proceed a particular task.

Potamitis et. al. [9] recommended a new home interactive approach for a disable person using voice recognition to control remotely the home appliances to ensure their can operate directly at their appliances everyday through speech.

Huiping Huang et. al. [10] studied the solution for a low power consumption remote home security alarm system using Wireless Sensor Network (WSN) and Global System for Mobile Communication (GSM)

technology that can detect the theft, gas leakage and fire, and send alarm message to the users. The benefit usage of Wireless Sensor Network (WSN) technology equipped with sensors, micro-Mechatronics and wireless communication, will identify, gather and manage the information and send the data to the receiver. This technology ability to cover in a large area with high precision remote monitoring, fast network and low cost.

The Wireless Sensor Network (WSN) system is formed from one centre node module and data collecting node modules, and this node will be shown in a different formation with a different application. This technology has a four parts which are data collecting unit, data processing unit, wireless communication unit and power management unit to form a WSN node module [11].

The wireless communication unit are known as a low power consumption unit and have a short distance Radio Frequency (RF) transceiver has been implemented in this system using wireless dual-way chip CC1100 integrated with C8051F310 MCU hardware is showed in Figure 2, to control and communicate the CC1100 parameter that can be set for working mode, read and write cache data and status register through Serial Peripheral Interface (SPI) which is included main output slave input (MOSI), main input slave output (MISO) and serial clock (CLK). To ensure the receiving and sending function of wireless communication system are working, the RF chip must be linked with MCU through SPI [12].

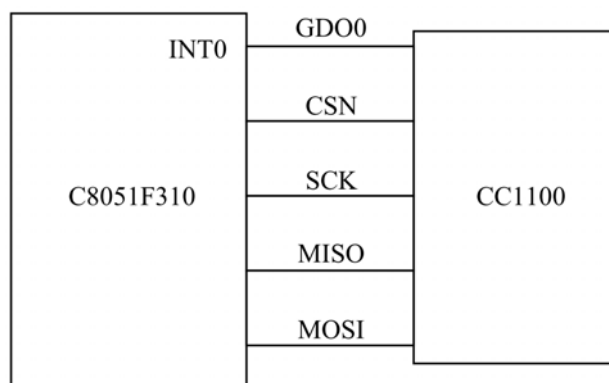


Fig. 2. The hardware connection between C8051F310 with CC1100 [12]

Figure 3 shows the diagram of the system for prototype that used C8051F310 MCU hardware as the data processing unit embedded with a temperature sensor to detect a room temperature.. The wireless receiver and SIMENS TC35 GSM module are included in this system. Enables to producing a C51 language to collect, receive, and transmit the short message alarm to the user’s mobile phone when some dangerous condition are detected [13].

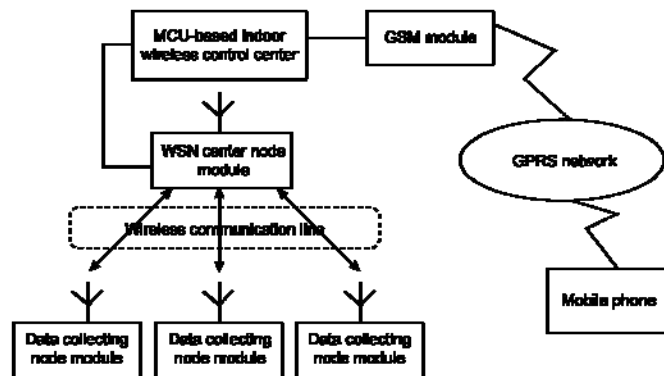


Fig. 3. Diagram of the Structural System [13]

TC35 GSM module will send alarm short message when wireless sensor network (WSN) node receives unusual data through Global System for Mobile communication (GSM) network. This module supports standard AT command set and its control by MCU hardware by entering a different AT function command using the serial port [14].

On the Table 1 are listed below, there are some of the GSM AT commands relevant to the short message [15].

TABLE I. AT Commands Relevant to Short Message [15]

AT Command	Command Function
AT+CSMS	Select short message service
AT+CMGF	Set short message encoding mode (1 for text mode, 0 for PDU mode)
AT+CSGS	Send short message
AT+CSCA	Short message service center number

The current version of TC35 GSM dual frequency module has added a new features such as compact and low power consumption, support GSM900 and GSM1800 frequencies, provide AT command interface, fast, reliable and safe transmission of data, voice, short message and fax [16].

By referring European Telecommunications Standards Institute (ETSI), there a three interface protocol for sending a short message which includes Block mode, Text mode and PDU mode and this interface will use for sending a short message mode and its rely on the short message service centre in the GSM network [17].

Grzegorz Sierpiński et. al. presented the application of Global System for Mobile Communication (GSM) supported with Global Positioning System (GPS) to manage the modal distribution in the cities. This system will provide the information to the travellers about the alternative transportation such as green cars, car-sharing systems, cleaner buses, trams and bicycles in order to reduce the congestion, transportation time losses, emission, noise pollution and fuel consumption. The previous research identifies that road transportation sector has ranked second highest in producing greenhouse emission in the European Union (EU) which is estimated about 40% of carbon dioxide (CO₂) and 70% from others emission. This statistic needs some of significant result to enhance the fuel consumption, especially for passenger cars [18]. The GPS will locate the individual and public transportation that currently on the route, then the information will transfer to the command centre of the GSM system to allow the travellers receives the information about the departure schedule and the delay of transportations. Figure 4 shows an example of electronic passenger information displayed [19].



Fig. 4. Example electronic passenger information displayed for public urban transportation in the city of Timisoara, Romania [19]

III. ARL DOOR SECURITY SYSTEM

The Alarm, Reminder and Locking (ARL) Security System is a security device designed and innovated to increase the security level for home, office rooms or other places to secure some of private documents or others valuable stuff. This is the significant purpose of this study to solve the issues of burglary at the premises that the confidential document is located. This device integrates with three functions that are alarming, reminder and looking for a purpose of safety. This device will locate at the door and connect to a user's mobile phone. The main component of this system is using the Arduino Uno R3 controller as shown in Figure 5, to setting the system data output using programming software and embedded with GSM/GPRS SIM 900 shield as shown in Figure 6, that's fully compatible with the Arduino controller to ensure the Short Message Service (SMS) reminder data will send directly to the users through a mobile phone.



Fig. 5. Arduino Uno R3 controller

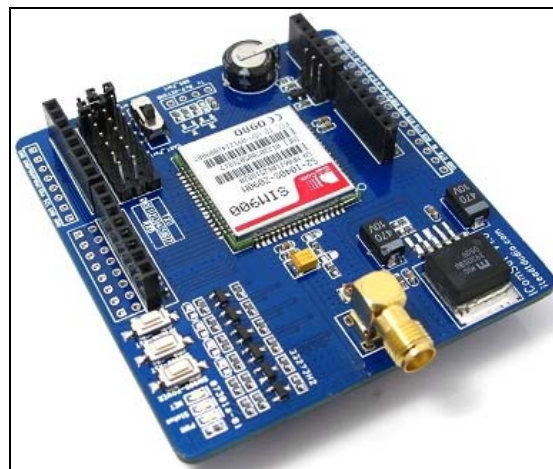


Fig. 6. SIM900 GSM/GPRS shield for Arduino

This device was set up with an alarm buzzer and it will be sound when a user leaves the room in 30 second and not close the door in a proper manner because the door sensor not detected each other's. This setting is a first response to the users to ensure they can close the door manually. In another situation, when users closed the door with proper but forgot to lock, in 5 minutes the system will automatically lock the door and SMS will be sent to the users through their mobile phone to remind them that the door is properly locked. The solenoid has been used as a locking system and it automatically works when the door sensor reacts each other. There is some improvement have been made of this security system upon intrusion occurrence. When an unrecognized person can intrude user's private room easily, the door sensor will react to generate an alarm buzzer and the GSM network system will activate to remind the user through SMS. The textual data will appear on the user mobile phone interface and mention, "your room was intruded". The advantage of this improvement is to ensure the user will know someone has intruded their private room and should be directly contact the authorities or trusted person to check-in the room as a security procedure. This device is generated using 12V power supply to activate the Arduino Uno R3 controller and solenoid. The diagram of the ARL circuit system shown in Figure 7, to specify the flow process of GSM technology and other electronic component integrated with controller to ensure the security level achieved. In Figure 8, 9 and 10 has been shown about the flow chart process of the whole system with a different situation.

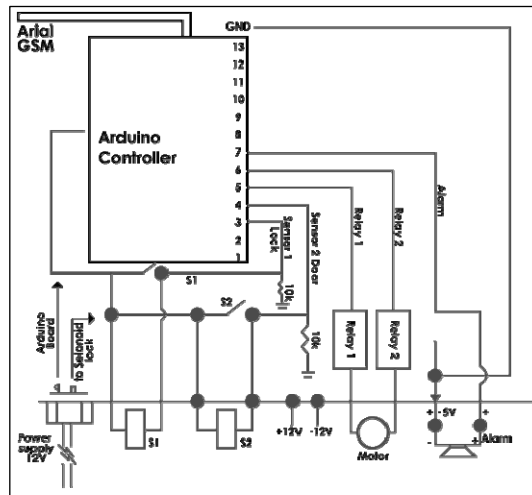


Fig. 7. ARL Security System Circuit Diagram with GSM

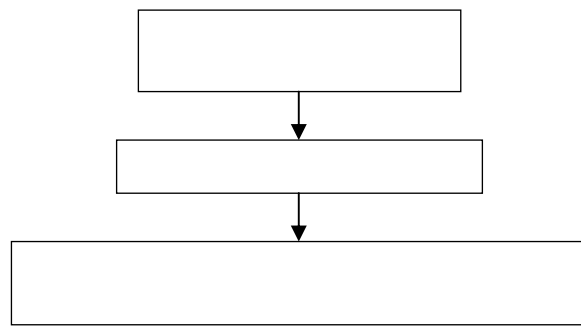


Fig. 8. The flow process of improper door closed

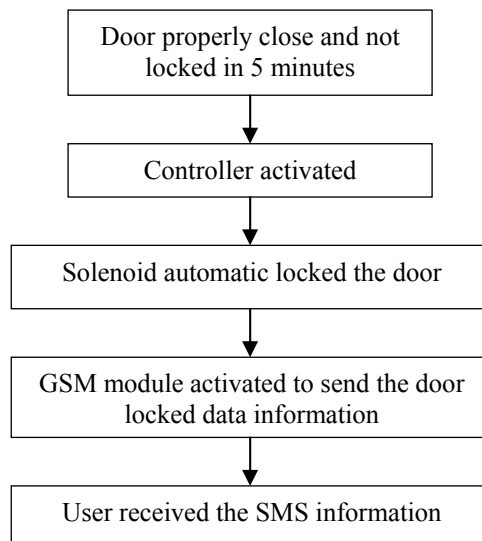


Fig. 9. The process flow of automatic locker

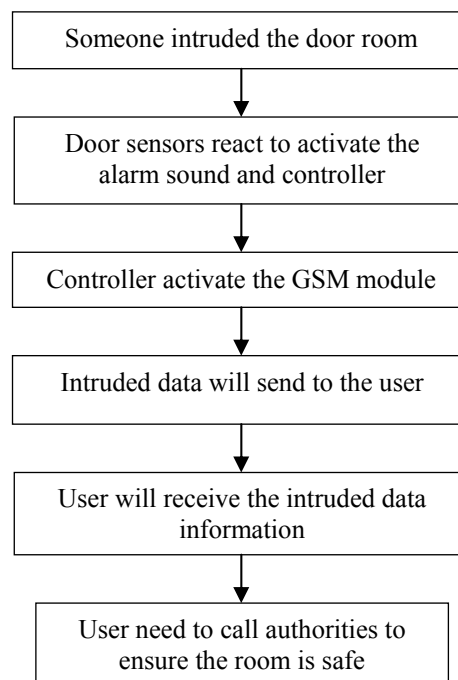


Fig. 10. Flow process of intrusion situation

IV. CONCLUSION

This paper introduce about the design of Alarm, Reminder and Locking (ARL) Security System use for private room to ensure any confidential documents and items are safe. This system has been used Arduino Uno R3 controller, GSM and SMS technology to integrate the electrical components such as alarm buzzer, magnetic door sensor and solenoid lock which is easy to install on the door. This technology will send the SMS reminder to the user mobile phone to confirm the door is properly locked and recognize the intrusion situation. The advantages of this system are user friendly, low power consumption and reasonable cost to install. In future, this system will develop, improve and integrate with others new technology that is suitable for all situations and location to be more efficient and robust application system. The continuity of this study will be helping people to prevent some of valuable items and against the intrusion situation.

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