Home Based Security and Safety System

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Declaration

I declare that this thesis is my own work and has not been submitted in any form for another degree or diploma at any university or other institution of tertiary education. Information derived from the published or unpublished work of others has been acknowledged in the text and a list of references is given.

Name of Student (s) Signature of Student (s)

Date:

Supervised by

Name of Supervisor(s) Signature of Supervisor(s)

Date:

Dedication

I dedicate my dissertation work to my teacher, my family and my friends.

Acknowledgements

I am greatly indebted to my supervisor Mr. M.F.M. Firdhous for all his guidance and assistance in accomplishment of this project. His kind encouragement, motivation and guidance during the implementation of this project are highly appreciated.

My sincere thanks go to my parents and my friends who encouraged me for doing this project.

Thank you very much.

Abstract

According to the Sri Lankan Police statistics house braking and theft incidents recorded in 2010, 2011 and 2012 was 18344, 17023 and 16759 respectively. There are considerable amount of house braking and theft happening in every year and also considerable amount of fire and liquefied petroleum gas explosion accidents taken place around our country. In order to solve these issues it is essential to develop a security and safety system that can affordable to any household.

The system is mainly comprises of two units as security and safety. Security unit mainly detects movements and send messages to the user. Safety unit detects LP gas and smoke in the house and send messages accordingly. Whole system is designed to work without electricity for more than 3 days and cost effectively.

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Chapter 1

Introduction

According to the Sri Lankan Police statistics [15] house braking and theft incidents recorded in 2010, 2011 and 2012 was 18344, 17023 and 16759 respectively. There are considerable amount of house braking and theft happening in every year and most of the times this kind of crimes taking place when owners are not at home. When consider about home based security and safety there were considerable amount of fire and liquefied petroleum gas (LP gas) explosion accidents taken place around our country. According to the research conducted by K. Rajmohan and J. Weerahewa., 2009[29], Sri Lanka is moving towards modern fuels such as LP gas and electricity. As mentioned in preliminary report of "Household Income and Expenditure Survey 2012/13"[16] 19% of whole Sri Lanka uses LP gas as cooking fuel; by that urban, rural and estate sectors uses 55.5%, 12.0% and 2.4% LP gas for cooking respectively. In 1990 household LP gas consumption was 28 and it was increased up to 159 thousand metric tons when it comes to 2010 [18]. Therefore it is an important issue to address home based security and safety in our country. There are intrusion systems, gas and fire alarm systems available internationally. But in Sri Lanka those systems are not very famous and may not available locally at household level such as gas and fire alarm systems. These systems are almost limited to larger companies due to their cost. The costs of these systems are very high. As an example a CCTV camera set with 4 Chanel HIKVISION Network DVR and 1 camera will cost 41,000.00 rupees [22] which is difficult to purchase by normal household. Users have to modify the structure of the place where they want to secure before use these systems so additional overhead will be added other than the item cost. And also most of the intrusion detection systems giving their top priority to keep out thief by using an alarm system or lighting system but there is no way to inform if you are not at home. Some intrusion detection systems use Wi-Fi network to inform about intrusions. But at present thieves are much more aware about this kind of systems so if they disconnect user's electricity or cut the telephone line there is no way to get user informed by the intrusion system. This is also same to fire and LP gas alarm systems. If user is not at

home, he will not be informed about any fire or LP gas leakage. So it is important to develop home based security and safety system which suits to Sri Lankan economy.

1.1 Aim and Objectives

1.1.1 Aim

Aim of the project is to develop a low cost home base security and safety system.

1.1.2 Objectives

- To develop low cost home based security and safety system.
- To give more functionalities regarding to security and safety.
- To develop fault tolerance system that can withstand without electricity and telephone connection.
- To develop portable system that can move whatever the place as needed by the user.
- To develop in-house alert system and sms based alert system in emergency.
- To develop web based solution to access captured images.

Chapter 2

Background

2.1 Introduction

Since commercial home security and safety systems are expensive, it is important to develop low cost commercial level product for normal households.

2.2 Arduino Platform

Arduino is an open-source electronics platform based on easy-to-use hardware and software. [10] It is a tool for making computers that can sense and control more of the physical world than your desktop computer. It's an open-source physical computing platform based on a simple microcontroller board, and a development environment for writing software for the board.

Arduino can be used to develop interactive objects, taking inputs from a variety of switches or sensors, and controlling a variety of lights, motors, and other physical outputs. Arduino projects can be stand-alone, or they can communicate with software running on your computer (e.g. Flash, Processing, MaxMSP.) The boards can be assembled by hand or purchased preassembled; the open-source IDE can be downloaded for free.

There are many other microcontrollers and microcontroller platforms available for physical computing. All of these tools take the messy details of microcontroller programming and wrap it up in an easy-to-use package. Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems like inexpensive, cross-platform, simple clear programming environment, open source and extensible software and hardware. There are various types of Arduino microcontroller board available in the market including the Arduino kits and Arduino shields. [11]

2.2.1 Arduino Uno board

The Arduino Uno is a microcontroller board based on the Atmel's ATmega328 microcontroller. "Uno" means one in Italian and it s the latest in a series of USB (Universal Serial Bus) Arduino boards, and the reference model for the Arduino platform. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, an ICSP header, and a reset button. The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. Operating voltage of this board is 5v and it is recommend to input 7-12v by simply connecting the board to the computer via USB or power it with a AC-to-DC adapter or battery pack. This has 32KB memory which 0.5KB used for the bootloader. It also has 2KB of SRAM and 1KB of EEPROM.

Figure 1: The Arduino Uno Board.

Reprinted from the Arduino Board Uno [9]

Figure 1 shows the Arduino Uno Board manufactured by the Arduino in Italy. It can be powered via a USB connection or with an external power supply. As can be seen in figure 1, pins A0 to A5 are the analog input pins, 14 digital input/output as pin 0 to 13 and the pins with a "~" sign can be used as the PWM output pins. The digital pins can be used as input or output pins by selecting the mode by using the function pinmode() and then using the function digitalRead() or digitalWrite() according to the necessity. Pins 0(RX) and 1(TX) are used for serial communication while pins 10(SS), 11(MOSI), 12(MISO) and 13(SCK) are used for SPI (Serial Peripheral Interface)

communication. In addition to pin 0 and 1, a SoftwareSerial library allows serial communication on any of the Uno's digital pins.

The Arduino Uno can be programmed with the Arduino software. Select "Arduino Uno from the Tools > Board menu. The ATmega328 on the Arduino Uno comes preburned with a bootloader that allows you to upload new code to it without the use of an external hardware programmer. You can also bypass the bootloader and program the microcontroller through the ICSP (In-Circuit Serial Programming) header using Arduino ISP or similar. [9]

2.2.2 ATmega328 Microcontroller

The microcontroller is a low-power CMOS (Complementary Metal Oxide Semiconductor) 8-bit microcontroller based on the AVR enhanced RISC (Reduced Instruction Set Computer) architecture. The powerful execution of instructions in a single clock cycle leads to the achievement of 1 MIPS per MHz throughputs allowing the designer to optimize power consumption versus processing speed.

The central processing unit (CPU) is the brain of the microcontroller which controls the execution of the program. The MCU (Microcontroller unit) consists of 4K/8K bytes of in-system programmable flash with read-while-write capabilities, 256/412/1K bytes EEPROM along with the 512/1K/2K bytes of SRAM. Along with this, the MCU consists of many other features:

- 23 general purpose I/O lines and 32 general purpose working registers
- flexible timer/counters with compare modes, internal and external interrupts and a serial programmable USART
- A byte-oriented 2-wire serial interface, an SPI serial port, a 6-channel 10-bit ADC (8 channels in TQFP and QFN/MLF packages), a programmable watchdog timer with an internal oscillator and 5 software-selectable power saving modes.

The five, software selectable, power saving modes are idle mode, Power-down mode, Power-save mode, ADC Noise Reduction mode and the Standby mode. As mentioned above, the CPU is the brain of the microcontroller which controls the execution of the program. Therefore the CPU is able to access the memories, perform calculations, control peripherals and handle interrupts. The AVR uses the Harvard architecture – with separate memories and buses for program and data to maximize the performance as well as the parallelism. The principle of execution of instructions in the program memory is the single-level pipelining. The concept of pre-fetching the next instruction while executing one instruction enables the instructions to be executed in every clock cycle and the program memory is in the System Reprogrammable Flash memory.

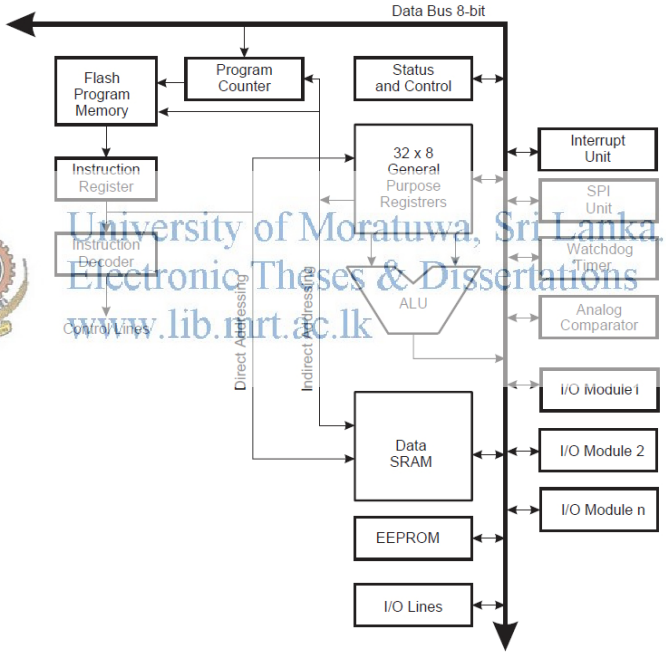

Figure 2: Block diagram of the AVR CPU Core architecture

Reprinted from Datasheet of ATMega328

The block diagram of AVR CPU Core architecture is shown in figure 2. The fast-access Register File contains 32 x 8 bit general-purpose working registers with a single cycle access time which results in a single-cycle ALU operation. The arithmetic and logical operations between the registers or between the constant and a

register are supported by the ALU. The status register is updated to reflect information about the result of the operation after an arithmetic operation.

The boot program section and the application program section are the two main sections of the program flash memory. Stack stores the return address of the program counter during the interrupts and subroutine calls which is allocated in the general data SRAM. The size of the stack is limited by the total size and usage of the SRAM. The data SRAM is accessible through five different addressing modes supported in the AVR architecture while the stack pointer is read/write accessible in the I/O space. The memory spaces in the AVR architecture are all linear and regular memory maps.

2.2.3 GPRS/GSM Shield

Figure 3: GPRS/GSM Shield

Reprinted from seller's website [12]

The GPRS/GSM Shield provides you a way to use the GSM cell phone network to receive data from a remote location. The shield allows you to achieve this via any of the three methods:

- Short Message Service
- Audio
- GPRS Service

The GPRS Shield is compatible with all boards which have the same form factor (and pinout) as a standard Arduino Board. The GPRS Shield is configured and controlled

via its UART using simple AT commands. Based on the SIM900 module from SIMCOM, the GPRS Shield is like a cell phone. Since SIM900 consumes more than 2A at its peak. This shield must work with an external power supply.

2.2.4 Eye-Fi card

The Eye-fi wireless memory card allows you to wirelessly transfer photos and videos from your camera to a Smartphone, tablet, file sharing site or computer. This memory card has built in wireless connectivity. It supports 802.11 b/g/n protocol on the 2.4 GHz band (5 GHz band not supported). The typical range of operation may vary from 13m to 27m.[32]

Figure 4: SanDisk 4 GB Eye-Fi wireless card

Reprinted from website [3]

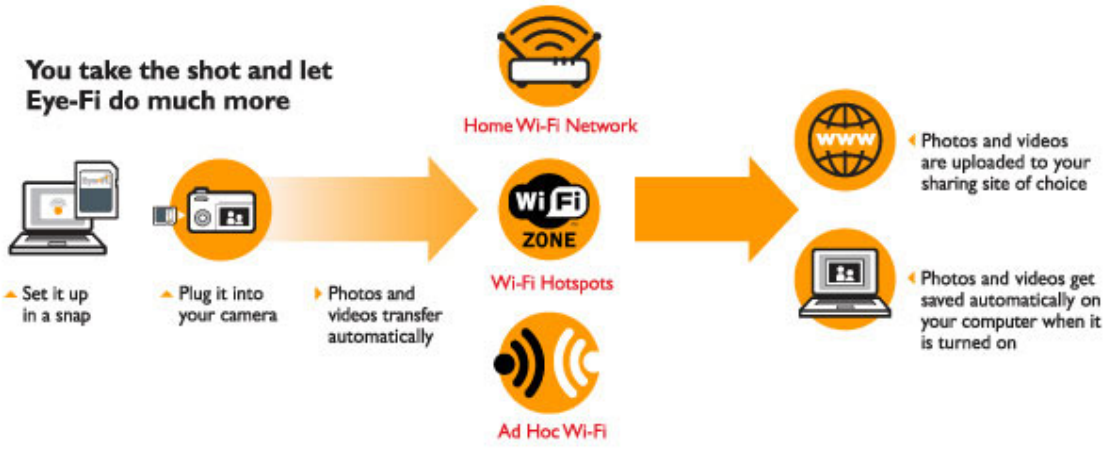

Figure 5: Eye-Fi card image sharing process

Reprinted from website [1]

2.3 Summery

Technology adapted to this project is discussed with all the details of the hardware used in this project.

System design and implementation of the system will be discussed in the next chapter.

Chapter 3

Design and Development

3.1 Introduction

This project is implements as two separate security and safety units. The technology used in this project is Arduino based microcontroller programming. Environment is continuously sense by sensors attached to the microcontrollers and it reacts according the inputs getting from those sensors controlled by the software.

3.2 System Design

The system mainly comprises two parts: the security unit and the safety unit. The security unit is responsible for detecting motion via the sensors. The passive infrared sensor detects motions in the environment and if there is a one it sends a signal to the camera to take 0.4 seconds of video. The camera controls by a relay attached to Arduino microcontroller. After taking the video it automatically uploads it to a file sharing site by connecting to the home wifi network. Security unit sends a sms message by information the movement of the environment to the user's phone. This unit is monitoring the out puts of safety unit and takes any input from the safety unit via a receiver attached to the security unit and sends appropriate sms messages to the user about the condition of the environment to get proper action to prevent if there is any danger.

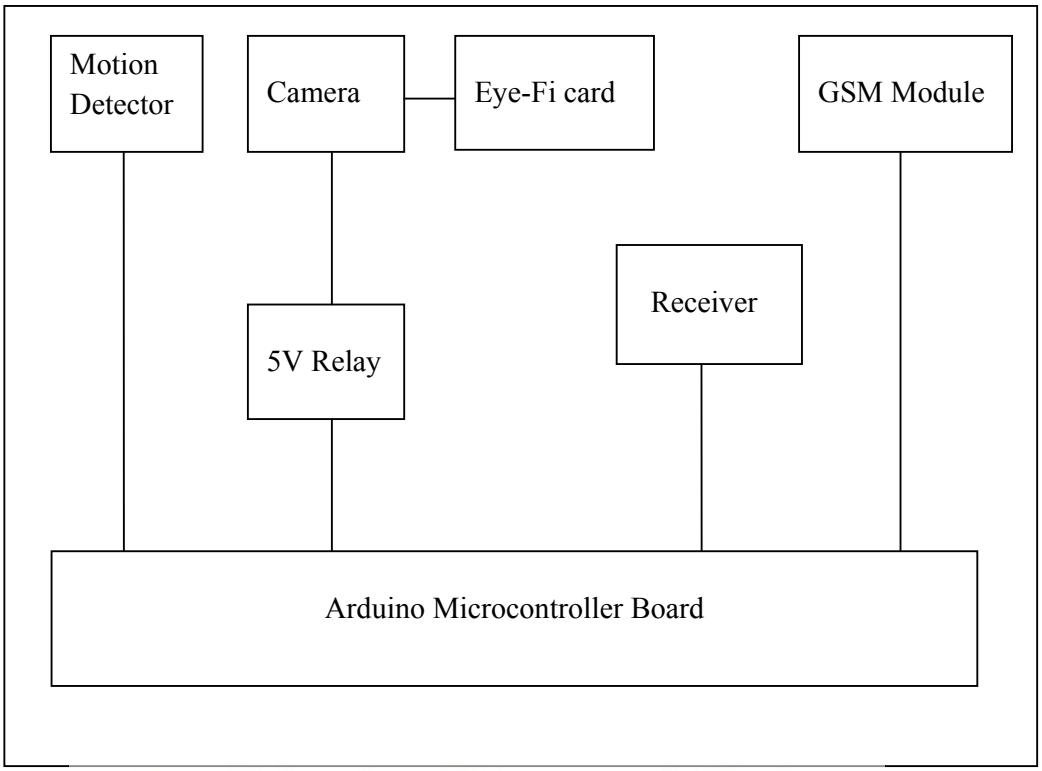

Figure 6: Block Diagram of the Security Unit

The block diagram of the system is shown in figure 14. As it is mentioned above, the system comprises two units. The safety unit has two sensors and a transmitter. Two MQ-2 smoke and LP gas sensors monitoring the environment smoke and LP gas values. If there is any value beyond the predefined limit, safety unit trigger a buzzer and sends a message to the security unit via the transmitter in order to send a sms to the user about the condition of the environment.

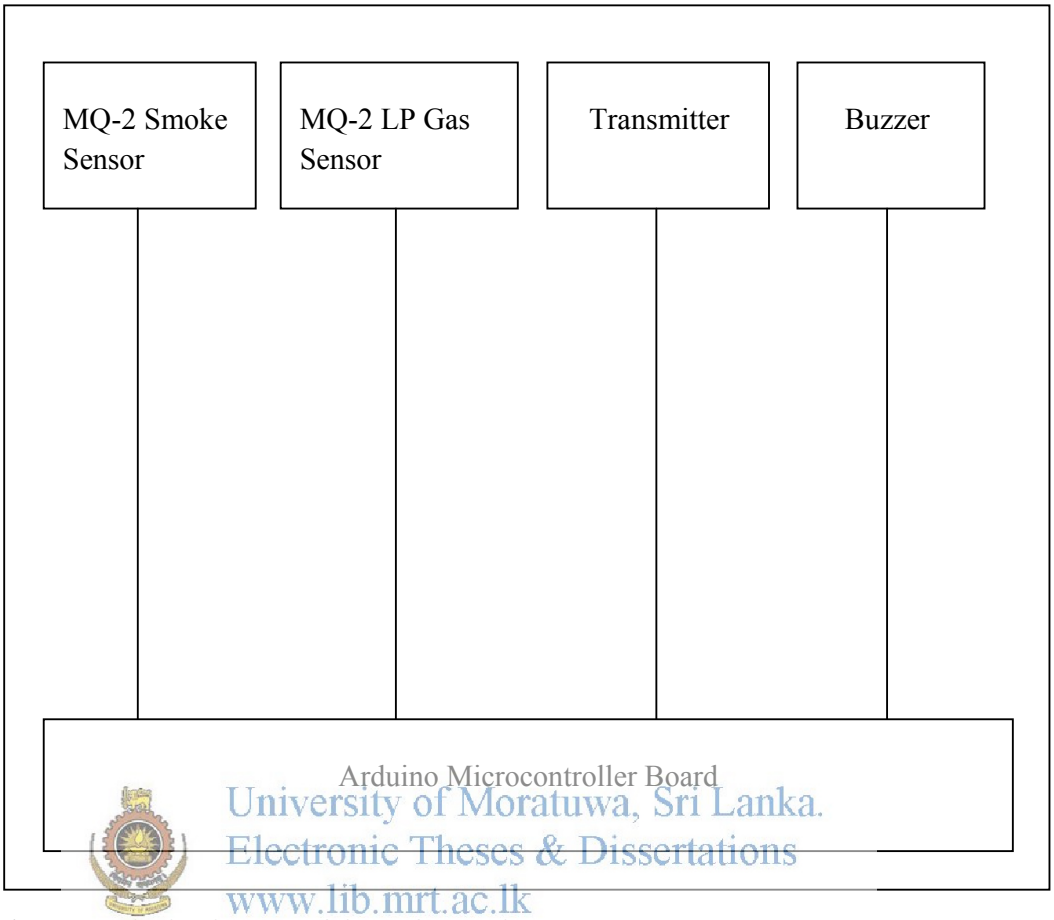

Figure 7: Block Diagram of the Safety Unit

The data from the sensors is continually processed by the microcontroller and an alert is send to the GSM module and other controllers (relay) if something is sensed or something reaches beyond the limit in the case of safety unit. These two units of the system are responsible for the security and safety of the home.

3.3 Interfacing Sim900 GPRS/GSM Module

The Sim900 GPRS/GSM module is an important part of the system responsible for sending messages to the user. For this system TinySine GSM module was used. GSM module is powered by using a 6V 4.5Ah lead acid battery.

```
#include "SIM900.h" //include header files
#include "sms.h"
Boolean started = false;
SMSGSM sms;  //SMSGSM type with sms variable
If(gsm.begin(4800){ //Initialize the gsm
started = true;
}
If(started){
sms.SendSMS("phone number", "Motion detect"); //command to send sms
}
```

List 1: GSM module syntax for interfacing with microcontroller

As in List 1, after including the header files and declaring the SMSGSM type GSM shield has to initialize. The initializing is done by using the gsm.begin() inside a conditional statement. If GSM module registered to the network correctly it set the started variable to true by allowing sending messages otherwise it remains as false and it will not send messages to the user. Supplying proper power to the GSM shield is very important since it may draw about 2A at the time of registration to the mobile network.

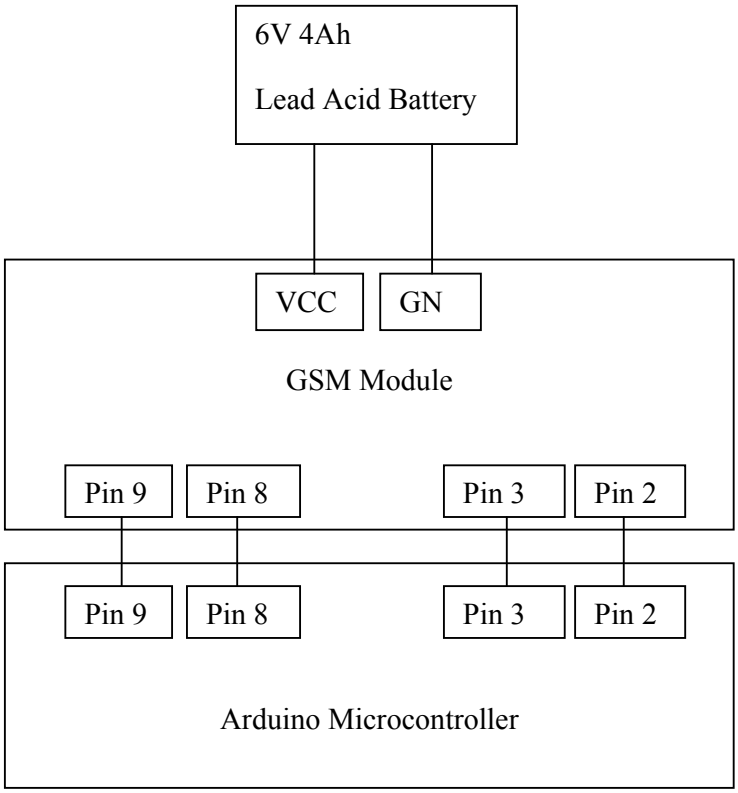

Figure 8: Block Diagram of Interfacing GSM Module with Arduino Microcontroller

3.4 Interfacing and Implementing Sensors

There are different areas which have to be monitored frequently in and around the house. Movement of strangers around or inside the house premises should be monitored. In addition smoke and LP Gas level of the home has to be monitored as well and trigger the buzzer upon reaching the critical point. The monitoring of smoke, LP Gas and a stranger's movement are done by the designated sensors. The operation of sensors is managed by software. Since there are different types of sensors, they are interfaced according to the output and properties of the sensor.

3.4.1 MQ-2 Smoke and LP Gas sensor

Smoke and LP Gas in a home has to be monitored in order to prevent it from happening fire or explosion and it is better to trigger the buzzer to indicate the danger of the situation. If owners are not in the house it will be very helpful to send them a sms message by informing the Smoke or LP Gas leakage situation. By these two

sensors it is always monitoring the environment for smoke and LP Gas level, if it reaches the critical point, a sms message will be sent out to the user and will be triggered a buzzer.

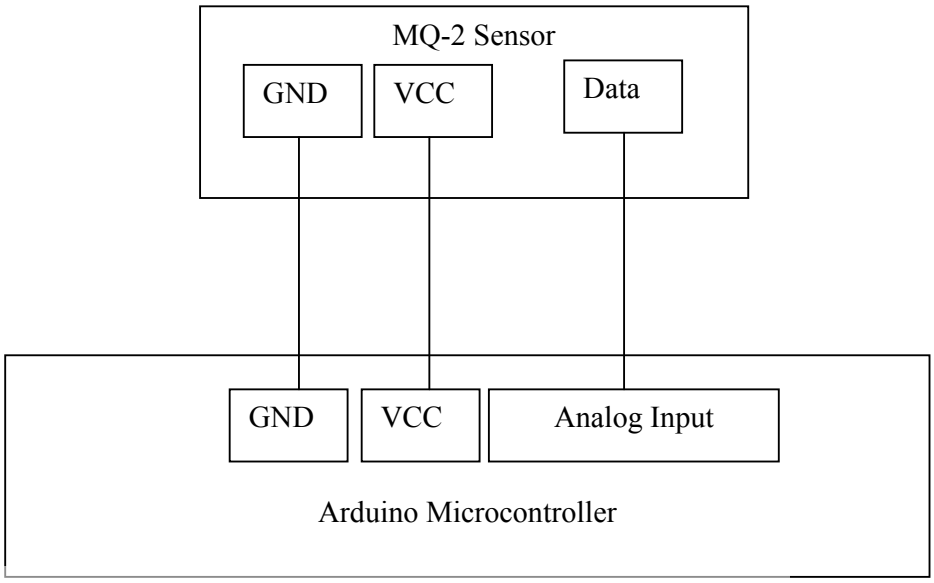

Figure 9: Block Diagram of the pin connection of MQ-2 sensor

The analog input port A0 and A1 of the Arduino board is used as the input for LP Gas and Smoke sensor respectively. 5V output port of the Arduino board is used as the power supply for these MQ-2 sensors. If sensor value goes beyond the defined limit then it will pass a string to the security unit via transmitter attached to the safety module. The code used to interface MQ-2 sensors is shown below:

```
const int analogInPinLP = A0; //LP gas sensor
const int analogInPinSmoke = A1; //Smoke sensor
int sensorValueLP = 0;
int sensorValueSmoke = 0;
sensorValueLP = analogRead(analogInPinLP);
sensorValueSmoke = analogRead(analogInPinSmoke);
if(sensorValueLP >= 160){
  digitalWrite(busser,HIGH);
//send string to the security unit
```

```
}else{
digitalWrite(busser,LOW);
}
if(sensorValueSmoke >= 230){
digitalWrite(busser,HIGH);
//send string to the security unit
}else{
digitalWrite(busser,LOW);
}
```

List 2: Code used to read Smoke and LP Gas values

Arduino microcontroller reads the input voltage of the sensor using the function analogRead(). If the input value exceeds the limit defined in the software, it will automatically sends as string to the security unit via transmitter and trigger the buzzer.

3.4.2 Motion Detector

Motion detectors are used to detect the unwanted movement of people around the restricted premises. Hence, the passive Infrared sensors could be used as a motion detector and the camera could be triggered if there is any movement around the restricted premises. The passive Infrared sensor manufactured by Panasonic is used as a motion detector in the system. The 5V power supply is given to the sensor through the board and the output of the sensor is connected to the digital input of the Arduino board. The digital output timing chart of the infrared sensor is shown in figure 10.

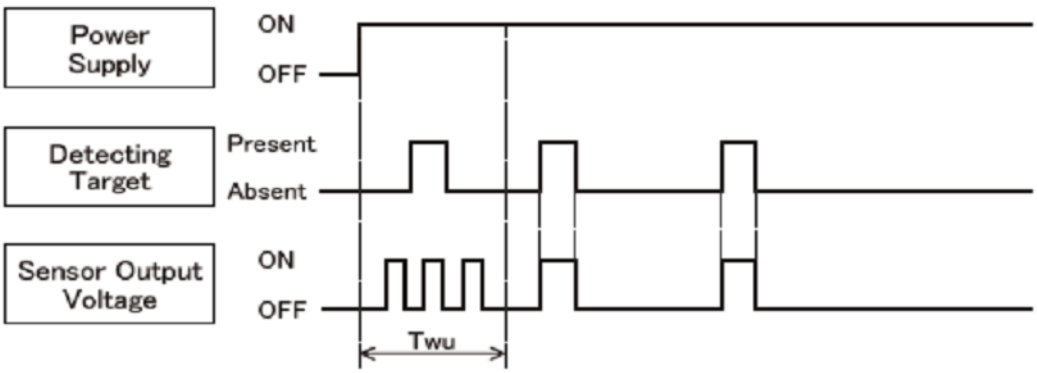

Figure 10: Digital output timing chart of passive infrared sensor

Reprinted from datasheet of Panasonic Passive Infrared Sensor[18]

As can be seen in figure 10, the sensor is activated by supplying a specified voltage provided by the manufacturer to the sensor. The output voltage of the sensor goes high whenever the target is detected in the sensor's field. Twu is the circuit stability time during which the sensor output voltage is undefined (ON/OFF) and detection is not guaranteed. Generally the circuit stability time is 30 seconds maximum.


```
int calibrationTime = 30;
long unsigned int lowIn;
long unsigned int pause = 5000;
boolean lockLow = true;
boolean takeLowTime;
int pirPin =6;
pinMode(pirPin,INPUT);
for(int i = 0; i < calibrationTime; i++){
delay(1000);
}
if(digitalRead(pirPin) == HIGH){
digitalWrite(ledPin, HIGH);
if(lockLow){
lockLow = false;
//take photo
```

```
pirHighCamera();
if(started){
sms.SendSMS("0783972406", "Motion detect");
delay(50);
}
}
takeLowTime = true;
}
```

List 3: Calibrating and interfacing PIR sensor code implementation

The C-language code implementation for calibrating and interfacing the passive infrared sensor is shown in listing 3. Since, the circuit stability time of the sensor is 30 seconds for maximum, the calibration time is provided in the software after the activation of the sensor and before the actual measurement by the sensor. There are only two possible states for the output of the sensor; either high or low. The output of the sensor is connected to the digital input port 5 of the board and the state is read in the software by using the function digitalRead(). As soon as it detects a person's movement around the place where the sensor is installed, an alert will be sent to the mobile phone informing about the person's movement and it triggers the digital camera to take 4 second of video and upload it to file sharing website.

3.5 Digital camera control via relay

Digital camera is used to take a 4 second of video around the surrounding environment. This digital camera is triggered by the signal from the motion sensor. "MEDION" digital camera was modified to interface with the Arduino board. 5V relay module is used to power on the camera when it receives the signal from motion detector and shutter button of the camera is also controlled by the relay in order to take a 4 second of video. Camera is connected to the Arduino via the 5V relay module and it operates according to the pirHighCamera() function.

```
#define RELAY1  7  //camera power
#define RELAY2  4 //camera shutter
void pirHighCamera(){
digitalWrite(RELAY1,0);          // Turns ON Relays 1
delay(800);
digitalWrite(RELAY1,1);
digitalWrite(RELAY2,1);          // Turns Relay Off
delay(2000);
digitalWrite(RELAY2,0);
delay(200);
digitalWrite(RELAY2,1);          // Turns Relay Off
delay(4000);  //4 second video
digitalWrite(RELAY2,0);
delay(200);
digitalWrite(RELAY2,1);          // Turns Relay Off
delay(90000);
digitalWrite(RELAY1,0);          // Turns ON Relays 1
delay(300);
digitalWrite(RELAY1,1);
 }
```


List 4: Cade of interfacing the camera via 5V relay

3.6 Eye-Fi card

Eye-Fi card is a kind of a SD card that has built in wifi capability. Eye-Fi card is used in the camera to save videos and at the same time it is capable of uploading the videos to a file sharing site. Using an Eye-Fi card is an efficient and cost effective way of sharing photos and images. Eye-Fi card should be configured to connect to the home wifi network. By setting the configuration options it can be choose which file sharing site to be used with the card.

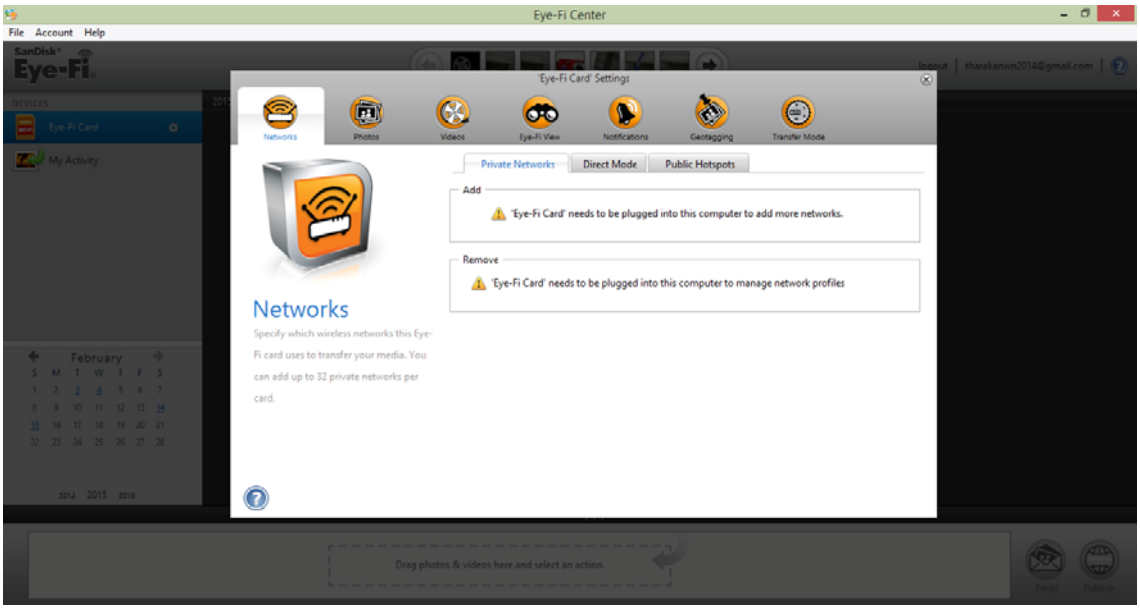

Figure 11: Eye-Fi card configuration window

3.7 315Mhz Wireless Transmitter and Receiver modules

This low cost 315Mhz wireless transmitter and receiver modules are used to make one way communication between safety unit and security unit. Since these two units are two separate items, these transmitter and receiver modules facilitate the proper communication between these two units. This has an operation range of 150m. Since GSM module is located in the security unit, safety unit has to communicate with the security unit to deliver sms messages to the user whenever it needs. Safety unit has a transmitter to transmit a string whenever smoke or LP Gas sensors receive higher values than specified in the software. Security unit has a receiver to receive what is sent by the transmitter. After receiving the string by the security unit, it processes the string and sends a sms message to the user by mentioning the situation.

```
#include <VirtualWire.h>
const int transmit_pin = 12;
const int receive_pin = 11;
const int transmit_en_pin = 5;
const char *on2 = "l";
const char *on3 = "s";
```

```
vw_set_tx_pin(transmit_pin);
vw_set_rx_pin(receive_pin);
vw_set_ptt_pin(transmit_en_pin);
vw_set_ptt_inverted(true);
vw_setup(300);
if(sensorValueLP >= 160){
vw_send((uint8_t *)on2, strlen(on2));
vw_wait_tx();
}
if(sensorValueSmoke >= 230){
vw_send((uint8_t *)on3, strlen(on3));
vw_wait_tx();
}
```

List 5: Safety unit, transmitter code


```
#include <VirtualWire.h>
uint8_t buf[VW_MAX_MESSAGE_LEN];
uint8_t buflen = VW_MAX_MESSAGE_LEN;
const int transmit_pin = 12;
const int receive_pin = 11;
const int transmit_en_pin = 5;
vw_set_tx_pin(transmit_pin);
vw_set_rx_pin(receive_pin);
vw_set_ptt_pin(transmit_en_pin);
vw_set_ptt_inverted(true); // Required for DR3100
vw_setup(300);          // Bits per sec
vw_rx_start();
if (vw_get_message(buf, &buflen))
{
if (buf[0] == 'l')
{
if(started){
sms.SendSMS("Phone Number", "Gas Leak in the house. Call police 119");
```

```
delay(500);
}
}else if(buf[0] == 's'){
if(started){
sms.SendSMS("Phone Number", "Smoke in the house. Call police 119");
delay(500);
}
}
}
```

List 6: Security unit, receiver code to send appropriate sms messages.

3.8 System Development

The home based security and safety system was developed by implementing the security and safety units. Custom Arduino Uno board was developed in order to reduce the cost and to remove unnecessary components which are drown power from the battery.

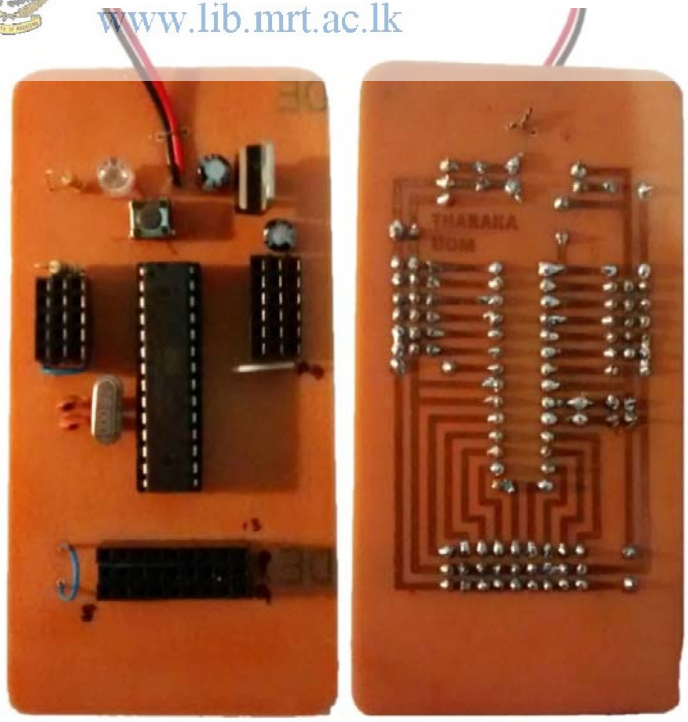

Figure 12: Custom Arduino Uno board built for this project

In this project, two sensors as MQ-2 and Panasonic passive infrared sensor and other electronic devices such as digital camera, 5V relay, GSM shield and 315Mhz transmitter/receiver module were used to detect environment changes and act according to that. Number of sensors used and the electronic devices can be increased or decreased according to the necessity of the application. This project was the demonstration project addressing the issues of Sri Lanka home based security and safety concerns with regarding to cost and portability. Security unit triggers the camera through the relay when detecting motion in the environment. Camera takes 4 second of video clip and uploads it to a file sharing site. At the same time it will trigger the GSM shield to send a sms message to the user by mentioning the movement in the surrounding. Safety unit is monitoring the environment smoke and LP Gas level using MQ-2 sensors. If it reaches beyond the defined limit by the software it will trigger a buzzer and send string to the security unit using 315Mhz transmitter to send a sms message to the user.

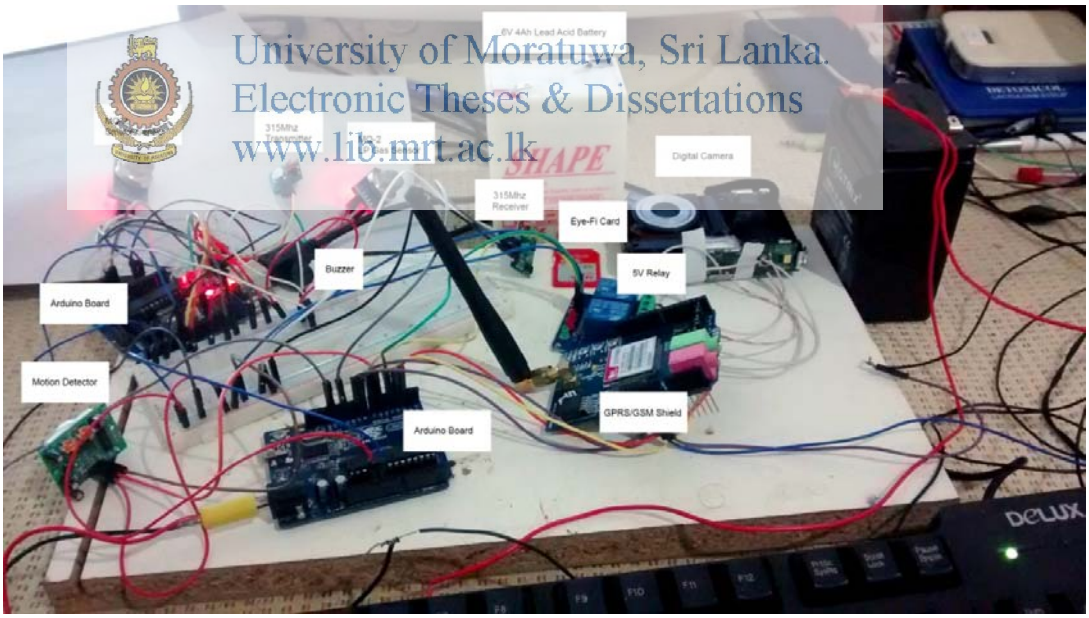

Figure 13: Final system

Figure 13 shows both security and safety units. In this project Arduino Uno board is used. Power supply to the devices can be provided externally using 6V 4.5Ah lead acid battery. The connections of sensors and devices can be seen in figure 13.The whole system is implemented using C-code language written on Arduino platform.

The software written on the platform can be uploaded to the microcontroller using Arduino IDE.

Figure 14: Screenshot of the Arduino IDE

The Arduino integrated development environment (IDE) is a cross-platform written in Java, whereas the programs are written in C or C++, which is shown in figure 14. The whole program is written in the platform in the C language code which can be uploaded to the board by a simple upload button. Basically, the project is the integration of the software (C language code) used to interface and implement the sensors, the GPRS module and the devices. In addition, the program contains some more code to coordinate among those parts along with some extra C code rather than the individual codes described above.

The application is a system from the hardware and software integration of different modules, sensors and devices. The sensors, GSM shield, relay and other devices such as buzzer connected to the Arduino board and the application program which controls the microcontroller is written in Arduino IDE as a C language code which can be uploaded to the board with the help of single button. It is always better to have a common ground of the system for better operation of the application, which is also followed here as the system has a common ground.

3.9 Testing the system

First of all, all the hardware units of the system were tested and it was ensured that they were in a good working condition. Then, each and every unit were interfaced and implemented individually with the microcontroller board and drove with the software according to the necessity of the application. The testing of the application was not done at once. Rather each unit of the application was tested individually. Security unit was tested first to get expected outcome and after that safety unit was tested. After both units working correctly, the units were kept together and then the whole system was developed and tested. It was easy to figure out the bugs and the problem of the system as the behavior of each unit was known while testing it.

3.10 Cost of development

Item	Quantity	Unit Price	Total
Arduino Board + Atmega328	2	500.00	1000.00
GSM Shield	1	4150.00	4150.00
Motion detector	1	220.00	220.00
MQ-2 sensors	2	370.00	740.00
Buzzer	1	10	10.00
315Mhz Transmitter/receiver	1	145.00	145.00
Digital Camera	1	2500.00	2500.00
Battery	2	550.00	1100.00
Eye-Fi card	1	2400.00	2400.00
5V relay	1	260.00	260.00
Total			12525.00

Table 1: Rough cost estimate to the project

3.11 Summery

System was implemented as two unites which are communicating wirelessly via wireless transmitter/receiver modules. Security unit is capable of detecting motions and trigger a digital camera to take 4 seconds of video. This video is uploaded to the internet using Eye-Fi card by connecting to the home wifi network. At the same time user will receive a sms message informing the detected motion. So wherever the user locate he will be able to see what is happening by looking at the uploaded video. Safety unit is continuously monitoring the environment smoke and LP Gas level. If there is any unusual increase beyond the defined limit by the software it will trigger a buzzer and send signal to the security unit to send a sms message to the user.

Chapter 4

Conclusion & Further work

4.1 Introduction

The main aim of the project was to develop an automated solution to address the prevailing home based security and safety issues in Sri Lanka and the goal was met. All the objectives defined at the beginning of the project were met. The whole system was developed with more functionalities as commercial systems by spending very low cost. A commercial solution with these facilities will be cost more than 50,000.00 rupees but this project was developed it by lowering the cost to 12525.00 rupees. This cost may reduce future if adapted to mass production. This system can withstand more than 3 days without electricity and it is totally independent of home telephone connection when sending sms alrets to the user. It is using home wifi network to upload captured video to the internet, if telephone connection is not available it will save all data to the SD card to access any other time. The whole system is portable that you can place it anywhere you need. These two units can operate within the range of 150m, so it has given user a great flexibility of positioning these two unites. Since security unit is capable of uploading videos to the internet, the user has a great facility to identify the situation of the house from anywhere in the world. Since safety unit has a built in buzzer, it will be very helpful to people in the home to identify any higher amount of smoke or LP Gas and do measures to prevent danger.

This system is fully capable of integrating more sensors and it is capable of handling more cameras. It will only cost 6000.00 rupees to integrate additional camera with all capabilities as taking videos, uploading them to internet, sending sms messages and detect motion. As a second option it can extend by using a camera without internet uploading capabilities just for 2600.00 rupees. So it is capable of extending this system with second option up to 11 cameras just for 38525.00 rupees (10 camera – 26000.00 + system – 12525.00) which is not possible with commercial products at this much of low price.

One of the biggest limitations of Arduino platform is lack of memory and processing power. Since it's processing power is very low, it is difficult to take photos and save it to SD card by using Arduino board. In this project external camera was used in order to overcome this limitation of the Arduino.

This project can be further extending to control a light at a room according to the sensor readings and can attach more sensors to monitor environment.

4.2 Summery

Aim of this projects and objectives were achieved successfully. Development of a security and safety solution which is suitable and affordable for Sri Lankan households for very low cost can be easily achieved with this project. This project can be extended by integrating more sensors, devices and cameras.

Chapter 5

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