Sudan Univeraity of Science and Technology
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Smart Entire Security System
نظام حماية شامل ذكي

A project Submitted In Patial Fulfillment of the requeremnt of the Degree of B.Sc. (Honor) In Electrical Engineering

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﴿اللَّهُ نُورُ السَّمَاوَاتِ وَالْأَرْضِ مَثَلُ نُورِهِ كَمِشْكَاةٍ فِيهَا مِصْبَاحٌ الْمِصْبَاحُ فِي زُجَاجَةٍ الزُّجَاجَةُ كَأَنَّهَا كَوْكَبٌ دُرِّيٌّ يُوقَدُ مِنْ شَجَرَةٍ مُبَارَكَةٍ زَيْتُونَةٍ لَا شَرْقِيَّةٍ وَلَا غَرْبِيَّةٍ يَكَادُ زَيْتُهَا يُضِيءُ وَلَوْ لَمْ تَمْسَسْهُ نَارٌ نُورٌ عَلَى نُورٍ يَهْدِي اللَّهُ لِنُورِهِ مَنْ يَشَاءُ وَيَضْرِبُ اللَّهُ الْأَمْثَالَ لِلنَّاسِ وَاللَّهُ بِكُلِّ شَيْءٍ عَلِيمٌ﴾ صدق الله العظيم

[35 :□□□□□ □□□□]

DEDICATION

To whom who has scarified and struggled for the sake of our well being and prosperity, dear father.

To the source of patience and optimism and hope, dear mother.

To those who has favored me than themselves, to those who taught me the meaning of life dear brothers.

To those with whom I tasted the most beautiful moments, my friends.

ACKNOWLEDGMENT

First of all we thank Allah for all those blessings we have day by day. Our beloved supervisor Ustaz Galal Abd-alrahman for his kindness and precious help, we thank our lovely families for the support we have got they have been there for us in each moment saying thank you won’t be enough either.

We also thank our teachers for their help, last of all we thank our friends those who make this journey an incredible one, each moment was irreplaceable, god bless them all.

ABSTRACT

Home security has been a major issue where crimes are increasing day by day and everybody wants to take proper measures to prevent intrusion, in addition the user can take the advantage of technological advancement of home automation, the project is aimed at developing the security home system against intrusion, gas leak and fire. If any of the above cases happened, the system will send SMS to house owner, capture a picture and turn on alarm, to implement these objectives we used an Arduino UNO and 1Sheeld chip based on ATmiga328 microcontroller.

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مع تزايد الجرائم يوما عن يوم أصبحت حماية المنازل من الأساسيات الضرورية, فأصبح كل شخص يفضل اتخاذ التدابير المناسبة إضافة إلي الاستفادة من مميزات التطور التكنولوجي للمنازل. يهدف المشروع لتطوير نظام حماية للمنزل ضد تسرب الغاز و الحرائق. عند حدوث أي من هذه المشاكل يـ قوم النظام بإرسال رسالة قصيرة, أخذ صورة و إطلاق جهاز إنذار. لتحـ قيق هذه الأهداف قمنا باستخدام أردوينو أونو و مايكروكنترولر.

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LIST OF SYMBOLS

MHz	Mega hertz
S	Stimulus
E	Electrical signal

LIST OF ABBREVIATIONS

HSS	Home Security System
SMS	Short Message Service
MEMS	Micro Electro Mechanical System
I/O	Input Output

RISC	Reduced Instruction Set Computer
DC	Direct Current
AC	Alternating Current
PWM	Pulse Width Modulation
SPI	Serial Peripheral Interface
ISCP	In Circuit Serial Programming
IDE	Integrated Development Environment
USB	Universal Serial Bus
FTDI	Future Technology Device International
UART	Universal Asynchronous Receiver Technology
E-mail	Electronic Mail
LED	Light Emitted Diode
PIR	Passive Infrared Radiation
IR	Infrared Radiation
LPG	Liquefied Petroleum Gas
IC	Integrated Circuit

CHAPTER ONE

INTRODUCTION

1.1 General Concepts

In recent years home security has shifted away from simple control panels and deadbolt locks into cool, coveted high-tech gadget that compose items on many homeowners wish list so the technology behind modern smart homes would likely be enough to blow the minds of our final project. Today we hear a lot about Smart home also known as automated home or intelligent home which indicates the automation of daily tasks with electrical appliances used in home. This could be the control of lights, fan, viewing of house interiors for surveillance purpose alarm alteration or indication in case of gas leakage. Home Security System (HSS) has changed a lot from the last century and will be changing in coming years our project will introduce a big innovation in security systems. It lets people watch their home or their offices on internet and using mobile devices whenever they want. This is a real-time system and users are warned by the system in emergency occasions like fire, water flood and thieves. The computer turns into a security system by adding the necessary software and hardware.

The HSS has lots of beneficial effects on society. Its social impact will be very important, because people far away from their home need not to be worried about it. People will be able to watch their home and give commands to the HSS by mobile devices. In the time of emergency they will be warned by the system by SMS and at that time the necessary process (calling police, fire brigade etc.) will be done by HSS. It is also very important for the police stations because the system will help them to determine the identity of the thief by using the database that the views are recorded. Briefly, the security need in the society is fulfilled.

1.2 Problem Statement

The main reason that we need to design a home security system is that now days houses and properties exposed for different sources of risks such as fire. These risks endanger people’s lives and it may lead to death. So many people don't think about their home’s security benefits until it is too late and they have already became victims. So by designing a home security system we may reduce those risks or even destroy them.

1.3 Objectives

The main objective of this project is to develop home security system that:

- To secure safety by taking immediate actions.
- Efficient communication will take place by using wireless communication technology to use social media services alert people.

1.4 Methodology

To design our project we needed to use a circuit that detect gas leak, fire and any movement of a stranger that trying to enter the house. Since we focused on how to protect your home when you are far away, we connected the user cell phone wirelessly so if there is an emergency occasion he will receive a text message, an image taken by the security camera and the alert will be played. We used the microcontroller as a programming technique.

1.5 Project Layout

Chapter one we discusses the general concepts, problem statements, objectives and methodology. While chapter two discusses the general information of the project such as the control, microcontroller and sensors. In Chapter three the circuit's components present in details. Chapter four contains the practical and simulation results. Chapter five consists of conclusion and recommendation.

CHAPTER TWO

GENERAL CONCEPTS

2.1 Introduction

Home automation is summed up as the mechanism of removing as much human interaction as technically possible and desirable in various domestic processes, and replacing them with programmed electronic systems, essentially the automation of the home housework. Home automation refers to the use of computer and information technology to control home appliances and features (such as windows or lighting). Systems can range from simple remote control of lighting through to complex computer/micro-controller based networks with varying degrees of intelligence and automation. Home automation is adopted for reasons of ease, security and energy efficiency. In modern construction in industrialized nations, most homes have been wired for electrical power, telephones, TV outlets (cable or antenna), and a doorbell. Many household tasks were automated by the development of specialized automated appliances. For instance, automatic washing machines were developed to reduce the manual labor of cleaning clothes, and water heaters reduced the labor necessary for bathing.

The use of gaseous or liquid fuels, and later the use of electricity enabled increased automation in heating, reducing the labor necessary to manually refuel heaters and stoves. Development of thermostats allowed more automated control of heating, and later cooling. As the number of controllable devices in the home rises, interconnection and communication becomes a useful and desirable feature. For example, a furnace can send an alert message when it needs cleaning or a refrigerator when it needs service. If no one is supposed to be home and the alarm system is set, the home automation system could call the owner, or the neighbors, or an emergency number if an intruder is detected.

In simple installations, automation may be as straightforward as turning on the lights when a person enters the room. In advanced installations, rooms can sense not only the presence of a person inside but know who that person is and perhaps set appropriate lighting, temperature, music levels or television channels, taking into account the day of the week, the time of day, and other factors.

Other automated tasks may include reduced setting of the heating or air conditioning when the house is unoccupied, and restoring the normal setting when an occupant is about to return. More sophisticated systems can maintain an inventory of products, recording their usage through bar codes, and prepare a shopping list or even automatically order replacements. Home automation can also provide a remote interface to home appliances or the automation system itself, to provide control and monitoring on a Smartphone or web browser. An example of remote monitoring in home automation could be triggered when a smoke detector detects a fire or smoke condition, causing all lights in the house to blink to alert any occupants of the house to the possible emergency. If the house is equipped with a home theater, a home automation system can shut down all audio and video components to avoid distractions, or make an audible announcement. The system could also call the home owner on their mobile phone to alert them, or call the fire department or alarm monitoring company [1,2].

2.2 **Control**

Automatic control has played a vital role in the advance of engineering and science. Automatic control has become an important and integral part of modern manufacturing and industrial processes. For example, automatic control is essential in the numerical control of machine tools in the manufacturing industries, in the design of autopilot systems in the aerospace industries, and in the design of cars and trucks in the automobile industries. It is also essential in such industrial operations as controlling pressure, temperature, humidity, viscosity, and flow in the process industries. Since advances in the theory and practice of automatic control provide the means for attaining optimal performance of dynamic systems, improving productivity, relieving the drudgery of many routine repetitive manual operations, and more, most engineers and scientists must now have a good understanding of this field [3]. In studying control engineering, we need to define additional terms that are necessary to describe control systems:

- **Plants**

A plant may be a piece of equipment, perhaps just a set of machine parts functioning together, the purpose of which is to perform a particular operation [3].

- **Processes**

An artificial or voluntary, progressively continuing operation that consists of a series of controlled actions or movements systematically directed toward a particular result or end [3].

- **Systems**

A system is a combination of components that act together and perform a certain objective. A system is not limited to physical ones. The concept of the system can be applied to abstract, dynamic phenomena such as those encountered in economics. The word system should, therefore, be interpreted to imply physical, biological, economic, and the like, systems [3].

- **Disturbances**

A disturbance is a signal that tends to adversely affect the value of the output of a system. If a disturbance is generated within the system, it is called internal, while an external disturbance is generated outside the system and is an input [3].

- **Feedback control**

Feedback control refers to an operation that, in the presence of disturbances, tends to reduce the difference between the output of a system and some reference input and does so on the basis of this difference. Here only unpredictable disturbances are so specified, since predictable or known disturbances can always be compensated for within the system [3].

Closed-loop control systems

Feedback control systems are often referred to as *closed-loop control* systems. In practice, the terms feedback control and closed-loop control are used interchangeably. In a closed-loop control system the actuating error signal, which is the difference between the input signal and the feedback signal (which may be the output signal itself or a function of the output signal and its derivatives and/or integrals), is fed to the controller so as to reduce the error and bring the output of the system to a desired value. The term closed-loop control always implies the use of feedback control action in order to reduce system error [3].

Open-loop control systems

Those systems in which the output has no effect on the control action are called open-loop control systems. In other words, in an open- loop control system the output is neither measured nor fed back for comparison with the input [3].

2.3 Microcontroller

A microcontroller is a single chip computer. Micro suggests that the device is small, and controller suggests that the device can be used in control applications. Another term used for microcontrollers is embedded controller, since most of the microcontrollers are built into (or embedded in) the devices they control. While people quickly recognized and exploited the computing power of the microprocessor, they also saw another use for them, and that was in control. Designers started putting microprocessors into all sorts of products that had nothing to do with computing, like the fridge or the car door that we have just seen. Here the need was not necessarily for high computational power, or huge quantities of memory, or very high speed. A special category of microprocessor emerged that was intended for control activities, not for crunching big numbers. After a while this type of microprocessor gained an identity of its own, and became called a microcontroller. The microcontroller took over the role of the embedded computer in embedded systems.

What distinguishes a microcontroller from a microprocessor that the microcontroller needs to be able to compute, although not necessarily with big numbers. But it has other needs as well. Primarily, it must have excellent input/output capability, for example so that it can interface directly with the ins and outs of the fridge or the car door. Because many embedded systems are both size and cost conscious, it must be small, self-contained and low cost. Nor will it sit in the nice controlled environment that a conventional computer might expect. No, the microcontroller may need to put up with the harsh conditions of the industrial or motor car environment, and be able to operate in extremes of temperature [4,5].
A generic view of a microcontroller is shown in Figure 2.1 essentially; it contains a simple microprocessor core, along with all necessary data and program memory. To this it adds all the peripherals that allow it to do the interfacing it needs to do. These may include digital and analog input and output, or counting and timing elements. Other more sophisticated functions are also available. Like any electronic circuit the microcontroller needs to be powered, and needs a clock signal (which in some controllers is generated internally) to drive the internal logic circuits [5].

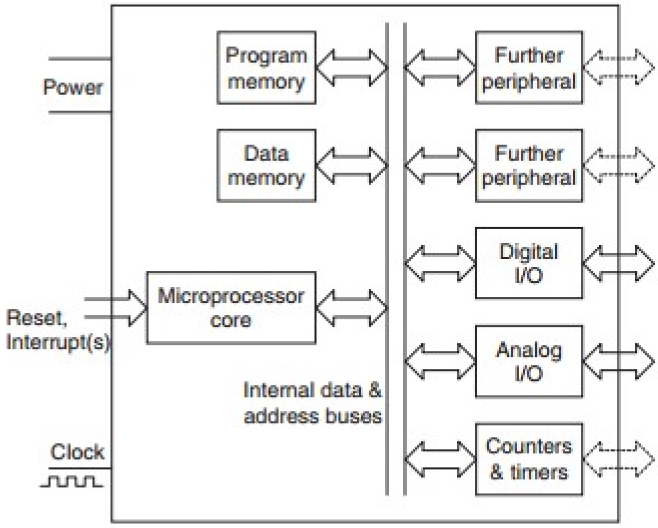

Figure 2.1: A generic microcontroller

- **Microcontroller families**

There are thousands of different microcontroller types in the world today, made by numerous different manufacturers. A manufacturer builds a microcontroller family around a fixed microprocessor core. Different family members are created by using the same core, combining with it different combinations of peripherals and different memory sizes. This is shown symbolically in Figure 2.2. This manufacturer has three microcontroller families, each with its own core. One core might be 8-bit with limited power, another 16-bit and another sophisticated 32-bit machine. To each core are added different combinations of peripheral and memory size, to make a number of family members. Because the core is fixed for all members of one family, the instruction set is fixed and users have little difficulty in moving from one family member to another [5].

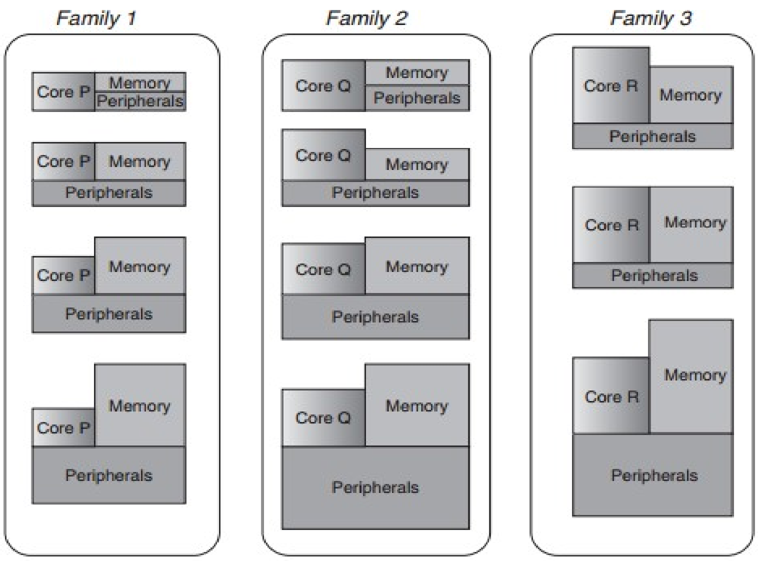

Figure 2.2: A manufacturer's microcontroller portfolio

While Figure 2.2 suggests only a few members of each family, in practice this is not the case; there can be more than 100 microcontrollers in any one family, each one with slightly different capabilities and some targeted at very specific applications. By the developing in a microcontroller appears new type of microcontroller called Arduino [5].

Arduino

There have been a number of Arduino versions, all based on an 8-bit Atmel AVR Reduced Instruction Set Computer (RISC) microprocessor. The first board was based on the ATmega8 running at a clock speed of 16 MHz with 8KB flash memory; later boards such as the Arduino NG-plus and the Diecimila (Italian for 10,000) used the ATmega168 with 16 KB flash memory. The most recent Arduino versions, Duemilanove and Uno, use the ATmega328 with 32 KB flash memory and can switch automatically between USB and DC power. For projects requiring more I/O and memory, there's the Arduino Mega1280 with 128 KB memory or the more recent Arduino Mega2560 with 256 KB memory. The boards have 14 digital pins, each of which can be set as either an input or output, and six analog inputs. In addition, six of the digital pins can be programmed to provide a Pulse Width

Modulation (PWM) analog output. A variety of communication protocols are available, including serial, serial peripheral interface bus (SPI), and I2C/ TWI. Included on each board as standard features are an In-Circuit Serial Programming (ICSP) header and reset button. Figure 2.3 shows the types of Arduino. Specialist boards called shields can expand the basic functionality of the Arduino; these can be stacked on top of each other to add even more functionality.[6,7]

Figure 2.3: Types of Arduino

Software for Arduino

To make Arduino do some useful work, you need to give it instructions. Software programs, called sketches, are created on a computer using the Arduino Integrated Development Environment (IDE). The IDE enables you to write and edit code and convert this code into instructions that Arduino hardware understands. The IDE also transfers those instructions to the Arduino board (a process called uploading).[6,7]

2.4 Sensors

A sensor is often defined as a “device that receives and responds to a signal or stimulus.” This definition is broad. In fact, it is so broad that it covers almost everything from a human eye to a trigger in a pistol. This world is divided into natural and human-made objects. The natural sensors, like those found in living organisms, usually respond with signals, having an electrochemical character, that is, their physical nature is based on ion transport, like in the nerve fibers (such as an optic nerve in the fluid tank operator). In manmade devices, information is also transmitted and processed in electrical form, however, through the transport of electrons. Sensors that are used in the artificial systems must speak the same language as the devices with which they are interfaced. This language is electrical in its nature and a man-made sensor should be capable of responding with signals where information is carried by displacement of electrons, rather than ions.1 thus, it should be possible to connect a sensor to an electronic system through electrical wires rather than through an electrochemical solution or a nerve fiber [8].

A sensor is a device that receives a stimulus and responds with an electrical signal. The purpose of a sensor is to respond to some kind of an input physical property (stimulus) and to convert it into an electrical signal that is compatible with electronic circuits. We may say that a sensor is a translator of a generally nonelectrical value into an electrical value. When we say “electrical,” we mean a signal, which can be channeled, amplified, and modified by electronic devices. The sensor’s output signal may be in the form of voltage, current, or charge. These may be further described in terms of amplitude, polarity, frequency, phase, or digital code. Therefore, a sensor has input properties (of any kind) and electrical output properties [8].

Any sensor is an energy converter. No matter what you try to measure, you always deal with energy transfer from the object of measurement to the sensor. The process of sensing is a particular case of information transfer, and any transmission of information requires transmission of energy. Of course, one should not be confused by an obvious fact that transmission of energy can flow both ways – it may be with a positive sign as well as with a negative sign; that is, energy can flow either from an object to the sensor or from the sensor to the object. A special case is when the net energy flow is zero, which also carries information about existence of that particular case. For example, a thermopile infrared radiation sensor will produce a positive voltage when the object is warmer than the sensor (infrared flux is flowing to the sensor) or the voltage is negative when the object is cooler than the sensor (infrared flux flows from the sensor to the object). When both the sensor and the object are at the same temperature, the flux is zero and the output voltage is zero. This carries a message that the temperatures are the same [8]. The term sensor should be distinguished from transducer. The latter is a converter of any one type of energy into another, whereas the former converts any type of energy into electrical energy as shown below in Figure 2.4 [8].

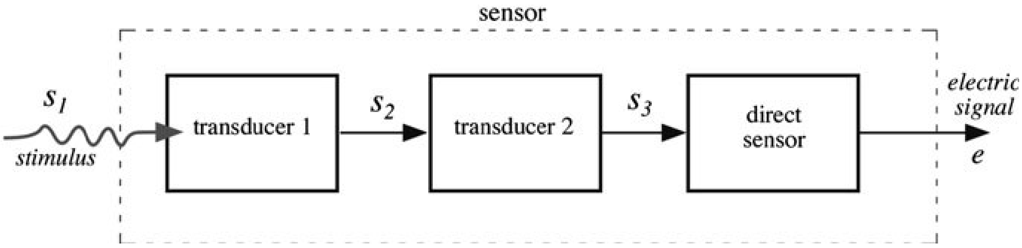

Figure 2.4: Converting measured energy to electrical signal

A sensor may incorporate several transducers. s1, s2, and so on are various types of energy, note that the last part is a direct sensor producing electrical output (e). A sensor does not function by itself; it is always a part of a larger system that may incorporate many other detectors, signal conditioners, signal processors, memory devices, data recorders, and actuators. The sensor’s place in a device is either intrinsic or extrinsic. It may be positioned at the input of a device to perceive the outside effects and to signal the system about variations in the outside stimuli. Also, it may be an internal part of a device that monitors the devices’ own state to cause the appropriate performance. A sensor is always a part of some kind of a data acquisition system. Often, such a system may be a part of a larger control system that includes various feedback mechanisms [8].

- **Sensor classification**

Sensor classification schemes range from very simple to the complex. Depending on the classification purpose, different classification criteria may be selected. Here, I offer several practical ways to look at the sensors.

- All sensors may be of two kinds: passive and active. A passive sensor does not need any additional energy source and directly generates an electric signal in response to an external stimulus. That is, the input stimulus energy is converted by the sensor into the output signal. The examples are a thermocouple, a photodiode, and a piezoelectric sensor. Most of passive sensors are direct sensors as we defined them earlier. The active sensors require external power for their operation, which is called an excitation signal. That signal is modified by the sensor to produce the output signal. The active sensors sometimes are called parametric because their own properties change in response to an external effect and these properties can be subsequently converted into electric signals. It can be stated that a sensor’s parameter modulates the excitation signal and that modulation carries information of the measured value [8].
- Depending on the selected reference, sensors can be classified into absolute and relative. An absolute sensor detects a stimulus in reference to an absolute physical scale that is independent of the measurement conditions, whereas a relative sensor produces a signal that relates to some special case [8].

CHAPTER THREE

CIRCUIT DESIGN

3.1 Introduction

In our design we focus on how to choose the component we need depending on high quality and low cost, our circuit mainly consists of those components: power supply, Arduino uno, 1Sheeld, keypad, buzzer, light emitted diode, passive infrared radiation, infrared radiation, motion sensor, MQ-2, LM35, regulator, exhaust fan, resistors and smart phone. We will discuss each one of them in details in this chapter.

3.2 Power Supply

All electronic circuits need power supply to operate. Different circuits need difference value of voltage which provides by the power supply as shown in Figure 3.1. Most of the microcontroller requires 5V (DC voltage) to operate. The information may be found from datasheet. To get 5V DC, we can use adaptors, voltage regulators or battery. Adaptor means that we buy the readymade power supply to power up the project.

Figure 3.1: Power supply

3.3 Arduino UNO

Arduino is an open-source physical computing platform based on a simple i/o board and a development environment that implements the Processing language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer. The Arduino Uno is a microcontroller board based on the ATmega328 shows in Figure 3.2. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the Atmega8U2 programmed as a USB-to-serial converter.

Figure 3.2: Arduino UNO

Table 3.1: Arduino UNO technical specification

Microcontroller	ATmega328
Operating Voltage	5V
Input Voltage (limits)	6-20V
Digital I/O Pins	14 (of which 6 provide PWM output)
Analog Input Pins	6
DC Current per I/O Pin	40 Ma
Flash Memory	32 KB of which 0.5 KB used by boot loader
SRAM	2 KB
EEPROM	1 KB
Clock Speed	16 MHz

In this electronic circuit the Arduino works as the main controller, it receives signals from the sensors and makes suitable actions that already programmed into it.

3.4 1Sheeld

1Sheeld is a platform for Arduino that allows you to tap into Smartphone’s sensors and capabilities and lets you use them in many different Arduino projects. Basically, 1Sheeld consists of two parts. The first part is a shield that is physically connected to your Arduino board and acts as a wireless middle-man, piping data between Arduino and any Android Smartphone via Bluetooth as shown in Figure 3.3.

Figure 3.3: 1Sheeld

The second part is a software platform and app on Android smart phones that manages the communication between our shield and your smartphone and let you choose between different available shields, the 1sheeld application shown in Figure 3.4.

Figure 3.4: 1Sheeld application

1Sheeld chip that used has the following technical specifications:

- Uses a standard HC-06 Bluetooth adapter (Bluetooth 2.1).
- Range up to 30 feet.
- Running on an Atmel ATMega162.
- 7.37 MHz operating frequency.
- Communicates with Arduino using UART.
- Communication baud rate 115,200 b/s.

1Sheeld can be operated by stacking it on the Arduino board directly. In this electronic circuit we use 1Sheeld to connect the Smartphone with the Arduino to be able to use the Smartphone’s network to send messages and E-mails and capturing pictures.

3.5 Keypad

This keypad has twelve buttons, arranged in a telephone-line 3x4 grid. It's made of a thin, flexible membrane material with an adhesive backing (just remove the paper) so you can attach it to nearly anything. The keys are connected into a matrix, so you only need seven microcontroller pins (3-columns and 4-rows) to scan through the pad, keypad connected to the Arduino by regular seven wires, those wires connected to seven input pins as shown in Figure 3.5.

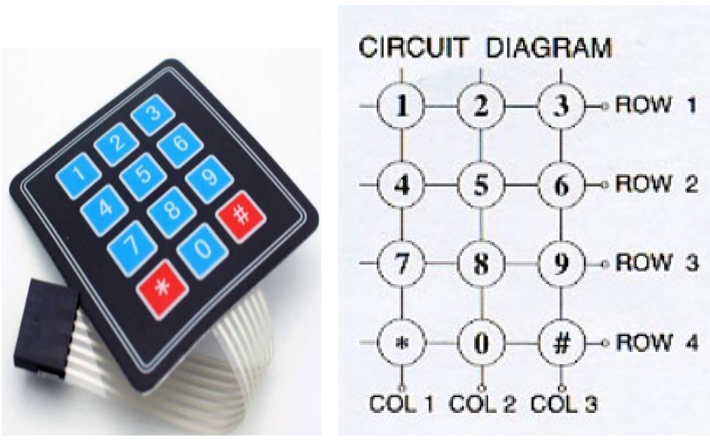

Figure 3.5: Standard keypad matrix circuit diagram

In this electronic circuit the keypad used to inter the system password to activate the security system or disable the alarm when it goes on.

3.6 Buzzer

Buzzer is an integrated structure of electronic transducers, DC power supply, widely used in computers, printers, copiers, alarms, electronic toys, automotive electronic equipment, telephones, timers and other electronic products for sound devices, buzzer can control with single-chip microcontroller IO directly and it working at 5 volts. The buzzer connected directly to one of Arduino output pins. In this electronic circuit we use the buzzer to give alarm when at least one of the sensors give a signal, the buzzer is shown in Figure 3.7.

Figure 3.6: Buzzer

3.7 Light Emitted Diode

A Light-Emitting Diode (LED) is a two-lead semiconductor light source. It is a p–n junction diode, which emits light when activated. When a suitable voltage is applied to the leads, electrons are able to recombine with electron holes within the device, releasing energy in the form of photons. LEDs create light by electroluminescence in a semiconductor material. Electroluminescence is the phenomenon of a material emitting light when electric current or an electric field is passed through it - this happens when electrons are sent through the material and fill electron holes. Semiconductor materials like germanium or silicon can be "doped" to create and control the number of electron holes. Doping is the adding of other elements to the semiconductor material to change its properties. By doping a semiconductor you can make two separate types of semiconductors in the same crystal. The boundary between the two types is called a p-n junction.

The junction only allows current to pass through it one way, this is why they are used as diodes. LEDs are made using p-n junctions. As electrons pass through one crystal to the other they fill electron holes. They emit photons (light). The LEDs connected to one of the Arduino's output pins. In this electronic circuit we used LEDs as indicators. Figure 3.7 shows the LED pins.

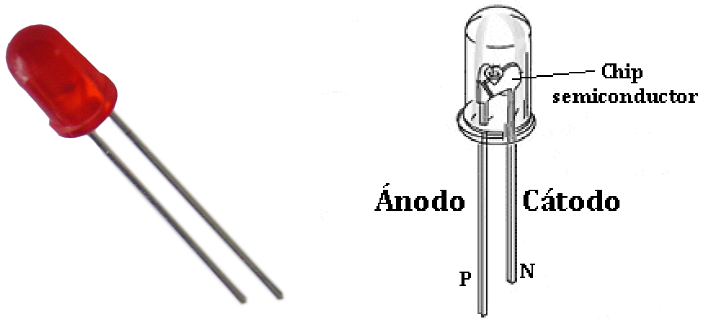

Figure 3.7: LED pins

3.8 Passive Infrared Radiation Sensor

It is an electronic sensor that measures Infrared (IR) light radiating from objects in its field of view. They are most often used in PIR-based motion detectors. All objects with a temperature above absolute zero emit heat energy in the form of radiation. Usually this radiation is invisible to the human eye because it radiates at infrared wavelengths, but it can be detected by electronic devices designed for such a purpose. Figure 3.8 represent s the circuit of the PIR sensor. A PIR-based motion detector is used to sense movement of people, animals, or other objects. They are commonly used in burglar alarms and automatically-activated lighting systems. The PIR sensor connected to one of the Arduino digital input pin. In this electronic circuit the PIR sensor used to detect any movement inside the house.

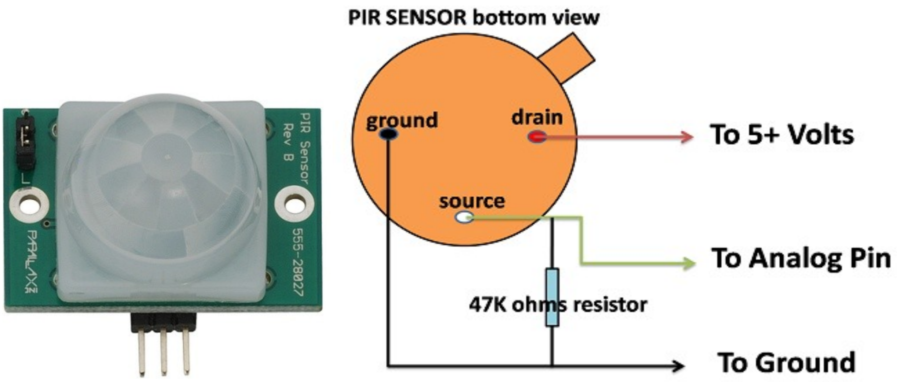

Figure 3.8: PIR circuit

3.9 Infrared Radiation Sensor

Infrared communication is a common, inexpensive, and easy to use wireless communication technology. IR light is very similar to visible light except that it has a slightly longer wavelength. This means IR is undetectable to the human eye so it’s perfect for wireless communication. IR sensor composed of parts, sender and receiver as shown in Figure 3.9. IR is connected as an input to the Arduino to detect any outside movement,.

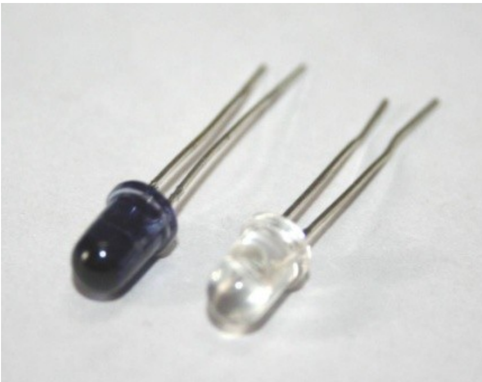

Figure 3.9: IR sensor

3.10 MQ-2 Sensor

The Grove - Gas Sensor (MQ2) module is useful for gas leakage detecting (in home and industry). It can detect Hydrogen (H2), Liquid Petroleum Gases (LPG), Methane (CH4), carbonated oxides (CO), Alcohol, Smoke, and Propane. Based on its fast response time measurements can be taken as soon as possible, Figure 3.10 shows the MQ-2 sensor. Also the sensitivity can be adjusted by the potentiometer. The MQ-2 sensor connected directly to one of the Arduino's analog input pins as shown in Figure 3.11. In this electronic circuit we use the MQ-2 sensor to detect gas leakage in the house and ignore the cook smoke and any un-harmful smokes.

Figure 3.10: MQ-2 sensor

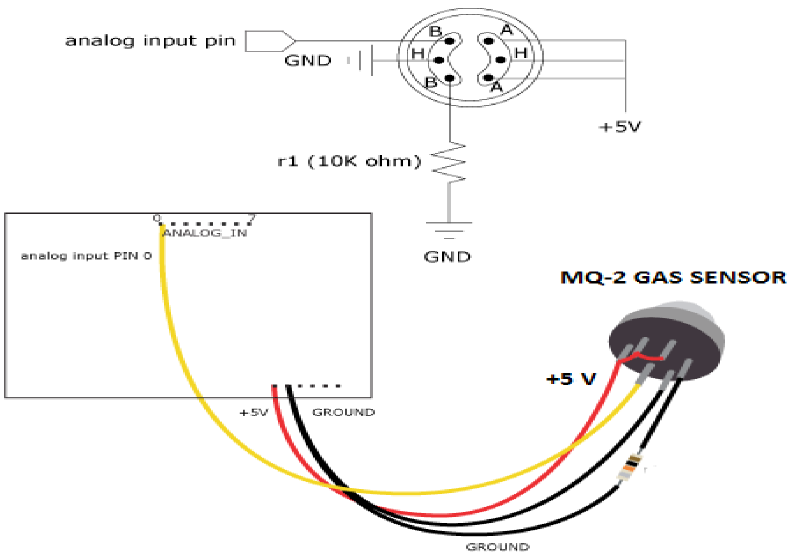

Figure 3.11: MQ-2 circuit

3.11 **LM35**

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C). The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every ºC rise/fall in ambient temperature. The LM35 connected directly to the Arduino board into one of the analog input pins. In this electronic circuit we use the LM35 to read the room heat and send a signal if it get higher than specific temperature which it indicate to fire ability. LM35 pin diagram shown in Figure 3.12.

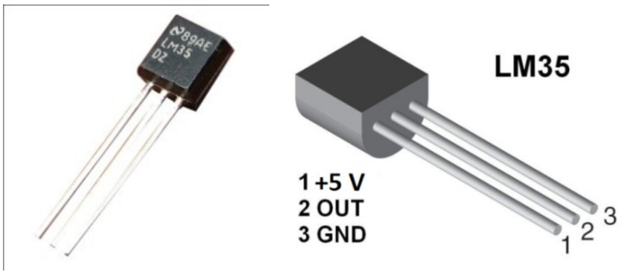

Figure 3.12: LM35 pin diagram

3.12 **Motion Sensor**

It’s a device that detects vibration or moving objects particularly people, a motion detector is often integrated as a component of a system that automatically performs a task or alerts a user of motion in an area as The motion sensor is installed in the door and connected directly to the Arduino to detect any attempt to break the door, motion sensor shown in Figure 3.13.

Figure 3.13: Motion sensor

3.13 **Voltage Regulator**

Voltage regulator is an IC that helps to regulate the voltage into desire DC voltage. it is designed to automatically maintain a constant voltage level. A voltage regulator may be a simple "feed-forward" design or may include negative feedback control loops it may use an electromechanical mechanism or electronic components. A voltage regulator generates a fixed output voltage of a preset magnitude that remains constant regardless of changes to its input voltage or load conditions. There are two types of voltage regulators: linear and switching. A linear regulator employs an active pass device (series or shunt) controlled by a high gain differential amplifier, it compares the output voltage with a precise reference voltage and adjusts the pass device to maintain a constant output voltage. A switching regulator converts the dc input voltage to a switched voltage applied to a power switch. The filtered power switch output voltage is feed back to a circuit that controls the power switch on and off times so that the output voltage remains constant regardless of input voltage or load current changes.

The voltage regulator connected into the circuit between the motion sensor and the Arduino, in this circuit we need to use the signal that comes out of the motion sensor which is equivalent to 12V as an input to Arduino, so we had to use the LM7805 regulator to give out 5V signal. Figure 3.14 shows the LM35 pins configuration.

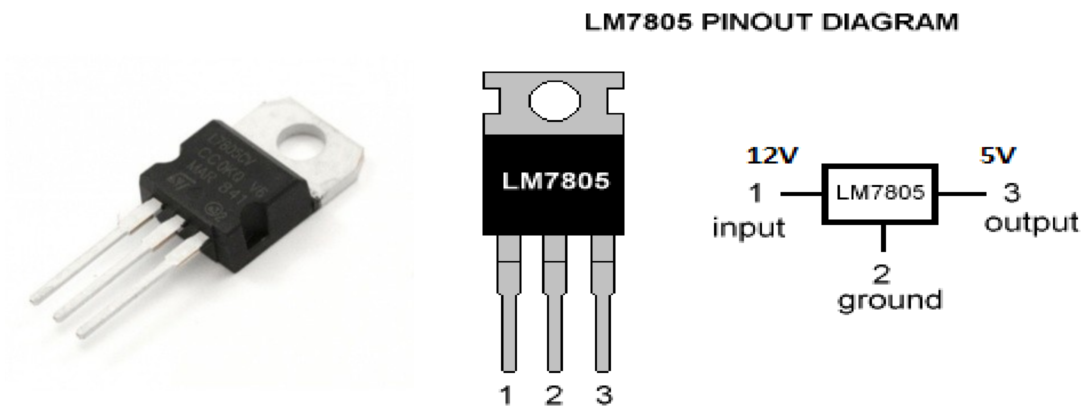

Figure 3.14: LM7805 pins configuration

3.14 **Exhaust Fan**

Exhaust fan is a mechanical ventilation device which, when ducted to the exterior of the house, draws out stale, impure and very humid air thereby improving the quality of indoor air. Usually it is installed in bathrooms and kitchens. In this circuit we use a computer cooling fan as shown in Figure 3.15. In this circuit the fan installed in the kitchen, when the MQ-2 sensor detect gas leakage the Arduino send a 5V signal to the fan to expel the air saturated with gas outside the kitchen.

Figure 3.15: 2-Wire computer fan

3.15 **Resistors**

A resistor is an electrical component that limits or regulates the flow of electrical current in an electronic circuit as shown in Figure 3.16. Resistors can also be used to provide a specific voltage for an active device such as a transistor. When used in series, resistors can be said to be a “voltage dividing network.” This is because in a series circuit, current flowing through each resistor is the same value but the voltage present across each resistor is only part of the total circuit voltage value. When used in parallel, resistors can be said to be a “current dividing network.” This is because in a parallel circuit, voltage across each resistor is the same value but the current flowing through each resistor only part of the total circuit current value. In this circuit we used resistors to protect the circuit’s components.

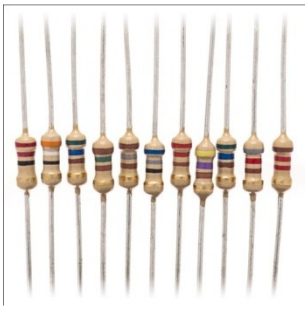

Figure 3.16: Resistors

3.16 **Smart Phone**

A smart phone is a mobile phone with an advanced mobile operating system which combines features of a personal computer operating system with other features useful for mobile or handheld use. In this project we used the 1Sheeld which it must be connected to a smart phone operated on Android operation system. The smart phone we used is connected to the internet, it will take pictures and back it up to Dropbox so the user can see the picture by signing in to his Dropbox account. Also the phone will send messages to the user telling him what is going on in his house, and it can even send an E-mail in case his phone is switched off.

CHAPTER FOUR

SYSTEM OPERATION

4.1 Introduction

In this chapter we focus on how to present the simulation of the whole circuit of our project, we found that in order to simulate it we will need to learn a lot more about simulating using Proteus, and we apply all sensors functions, practical circuits and their output in each case. Our model has been written in details with a picture of every operation to perform it clearly. As a result in this chapter we can see clearly how our project will work, each case we assume, the output in each case.

4.2 Simulation

To write the program and make a simulation for the electrical circuit we used two software applications, Arduino Integrated Development Environment (IDE) and Proteus software.

4.2.1 Arduino IDE

The Arduino IDE is a cross-platform application written in Java, and derives from the IDE for the Processing programming language and the Wiring projects. It is designed to introduce programming to artists and other newcomers unfamiliar with software development. It includes a code editor with features such as syntax highlighting, brace matching, and automatic indentation, and is also capable of compiling and uploading programs to the board with a single click. A program or code written for Arduino is called a "sketch". Arduino programs are written in C language. The Arduino IDE comes with a software library called "Wiring" from the original Wiring project, which makes many common input/output operations much easier as shown in Figure 4.1.

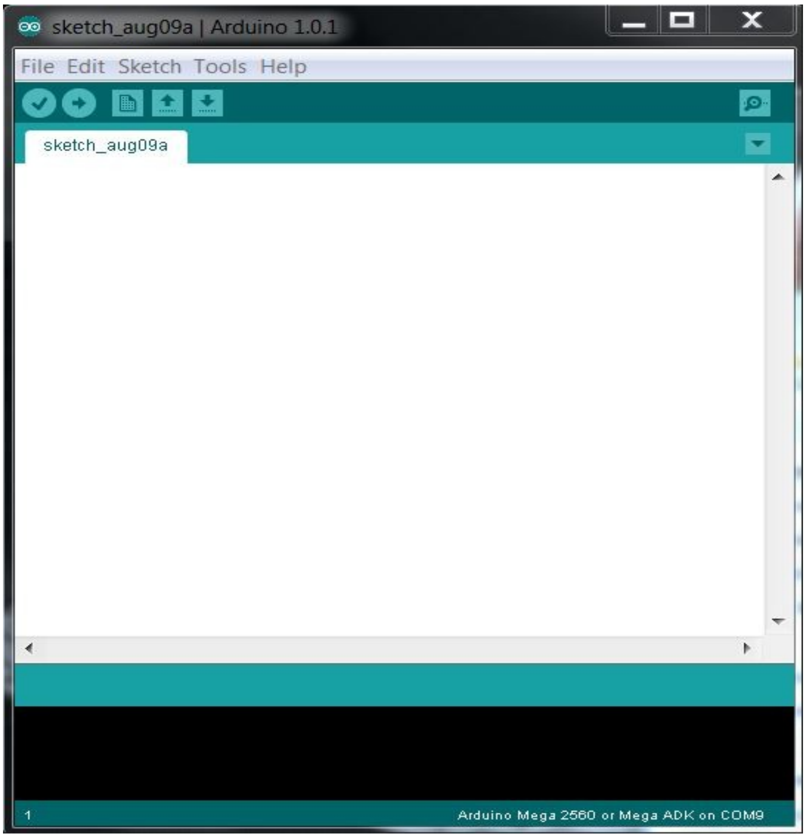

Figure 4.1: Arduino IDE software

4.2.2 Proteus

Proteus software contains everything you need to develop, test and virtually prototype your embedded system designs based around the Microchip Technologies of microcontrollers. The unique nature of schematic based microcontroller simulation with Proteus facilitates rapid, flexible and parallel development of both the system hardware and the system firmware. This design synergy allows engineers to evolve their projects more quickly, empowering them with the flexibility to make hardware or firmware changes at will and reducing the time to market. Proteus VSM models will fundamentally work with the exact same HEX file as you would program the physical device with, binary files produced by any assembler or compiler. We will use ISIS for simulating Arduino response, it has many variety modeling libraries, and its powerful concentrates in microcontroller units and microprocessor units modeling, Proteus software shown in Figure 4.2.

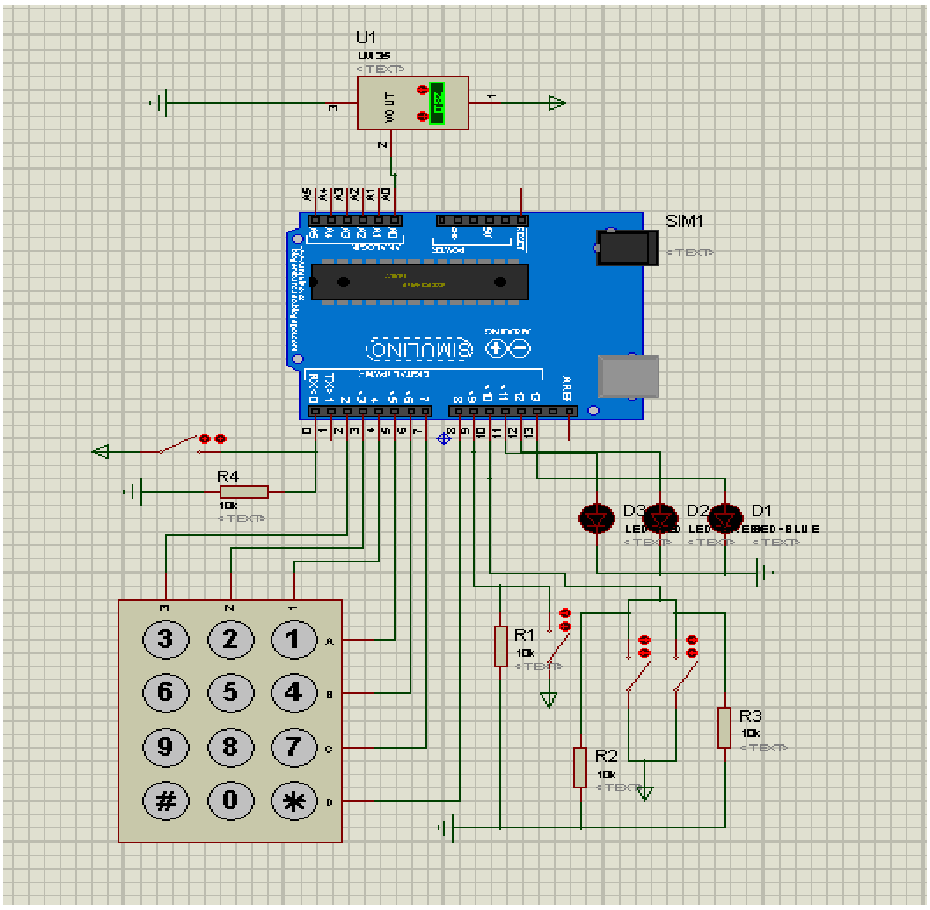

Figure 4.2: Proteus software

4.3 Practical

The security system that shown in the Proteus simulation locked with password, when the user enter the password using the keypad and press the "*" button to confirm the password the system will be deactivated and no alarm will go on when the user open the door and go into the house. While the system being deactivated the gas leakage protection and the fire protection will still working and the alarm will go on if there's a gas leakage or a fire. To activate the system the user have to press the "#" button, then if the system detect any motion, high heat or gas leakage it will start the alarm. Figure 4.3 shows outside view of the project.

Figure 4.3: Outside view of the project

In practical part we used sensors to detect movement, heat and gas. The sensors that we used are:

- Motion sensor
- PIR sensor
- IR sensor
- MQ-2 sensor
- LM35

Motion sensor

The motion sensor installed in the door to detect any attempt to penetrate the door, shown in Figure 4.4.

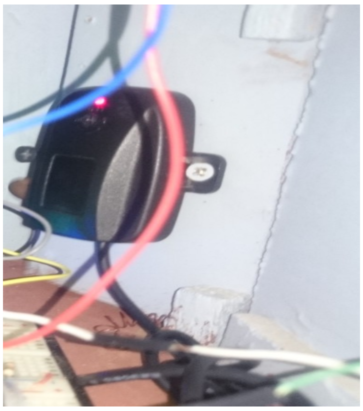

Figure 4.4: Motion detector sensor

When the system detect any movement in the door as shown in Figure 4.5 without entering the password it will turn on the alarm as shown in Figure 4.6 and will capture a picture with the camera that installed in the hall facing the door, also it will send to the house owner a message says “SOME ONE IS TRYING TO UNLOCK YOUR HOUSE LOCK.. CHECK” as shown in Figure 4.7.

Figure 4.5: Outside view of the door opened

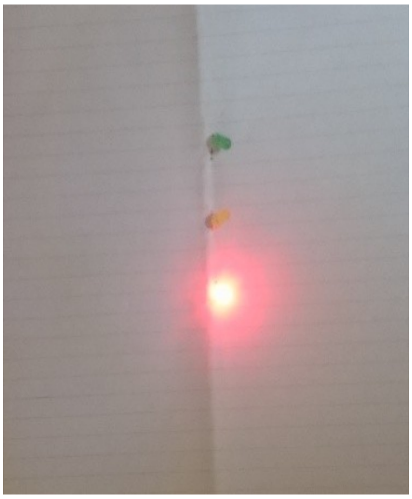

Figure 4.6: Red light indicating to alarm

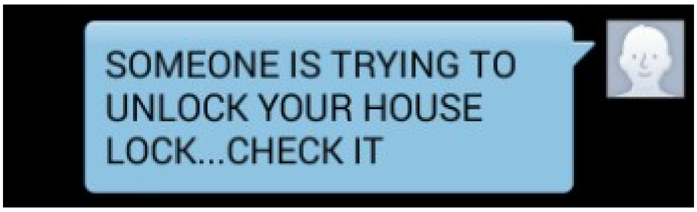

Figure 4.7: Unlock message to house owner

- **PIR sensor**

The PIR sensor installed inside the hall to detect any movement in the house, as shown in Figure 4.8.

Figure 4.8: PIR sensor

When the system detect movement in the hall as shown in Figure 4.9 it will turn on the alarm as shown in Figure 4.10 and will take a picture with the camera and send a message says “SOMEONE IS WALKING AROUN THE HALL.. TAKE CARE” to the house owner as shown in Figure 4.11.

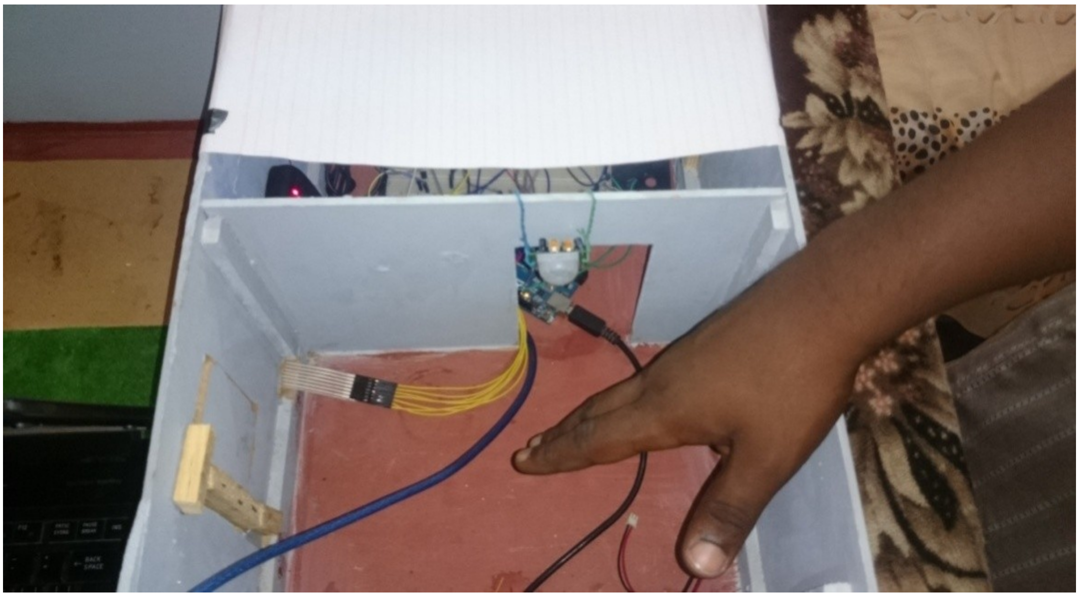

Figure 4.9: Movement around the hall

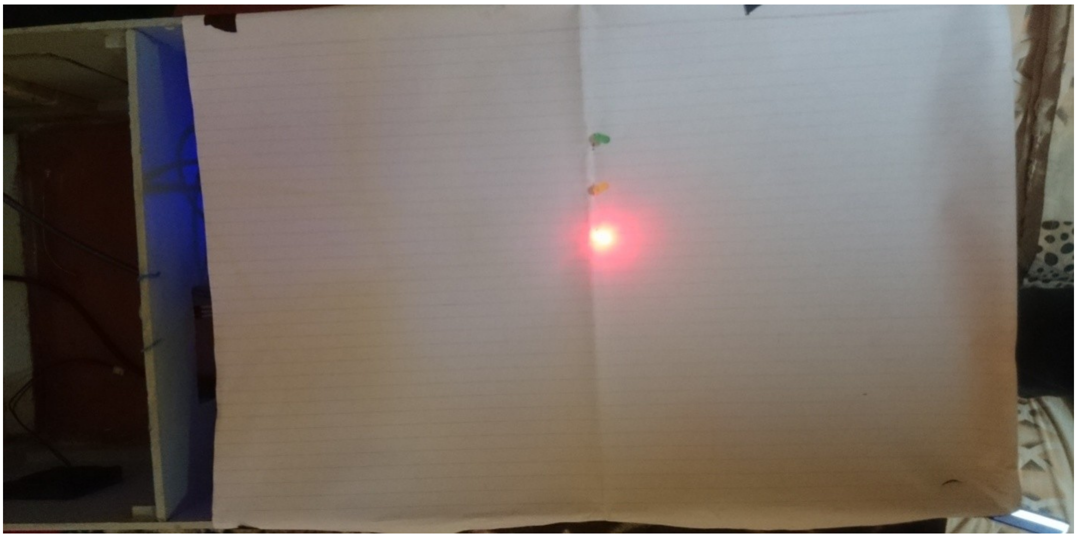

Figure 4.10 Red light indicating to alarm goes on when a movement happen

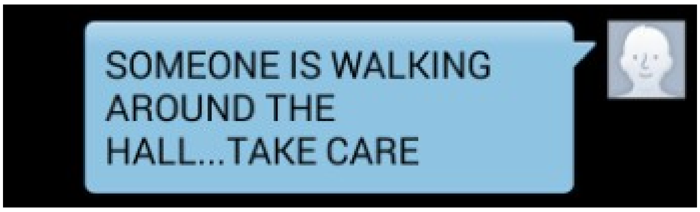

Figure 4.11: Take care message to house owner

- **IR sensor**

The IR sensor installed in the inner side of the window to detect any tries to open the window without the system deactivated as shown in the Figure 4.12.

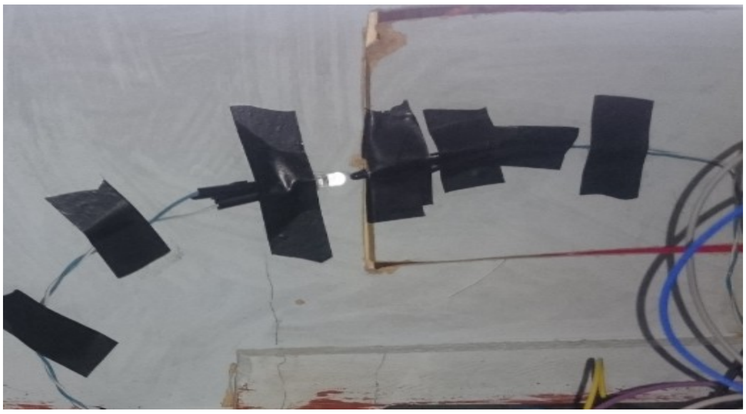

Figure 4.12: IR sensor

When the window opened as shown in Figure 4.13 without entering the password the system will turn on the alarm as shown in Figure 4.14 and take a picture with the camera and send a message to house owner says “SOMEONE IS TRYING TO BREAKE YOUR WINDOW.. HURRY UP” as shown in Figure 4.15.

Figure 4.13: Window opened

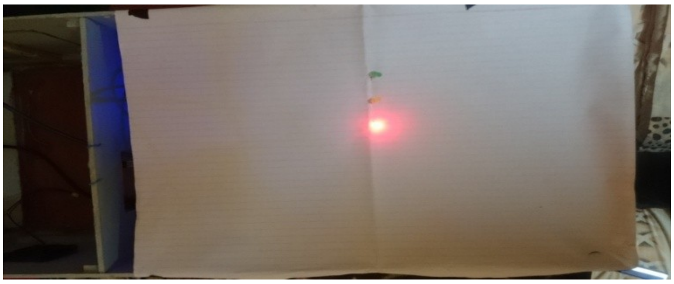

Figure 4.14: Red light indicating to alarm goes on when the window opened

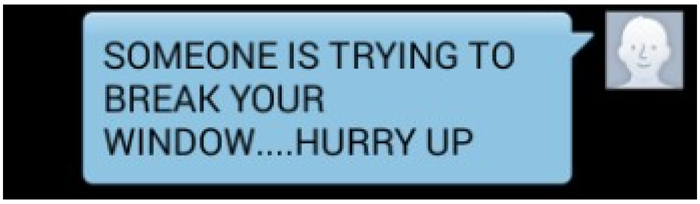

Figure 4.15: Break window message to house owner

- **MQ-2 sensor**

The MQ-2 sensor installed in the kitchen because it’s the main source of the gas in the house, the MQ-2 sensor will detect any gas leakage and will ignore the cooking’s smoke . Figure 4.16 shows the MQ-2 sensor.

Figure 4.16: MQ-2 sensor

When there is a gas leakage as shown in Figure 4.17 the system will turn on the alarm and will turn on the exhaust fan to expel the polluted air out the kitchen to prevent from fire risks, and also will send a message to house owner says “THERE IS A LEAKAGE IN THE GAS” as shown in Figure 4.18.

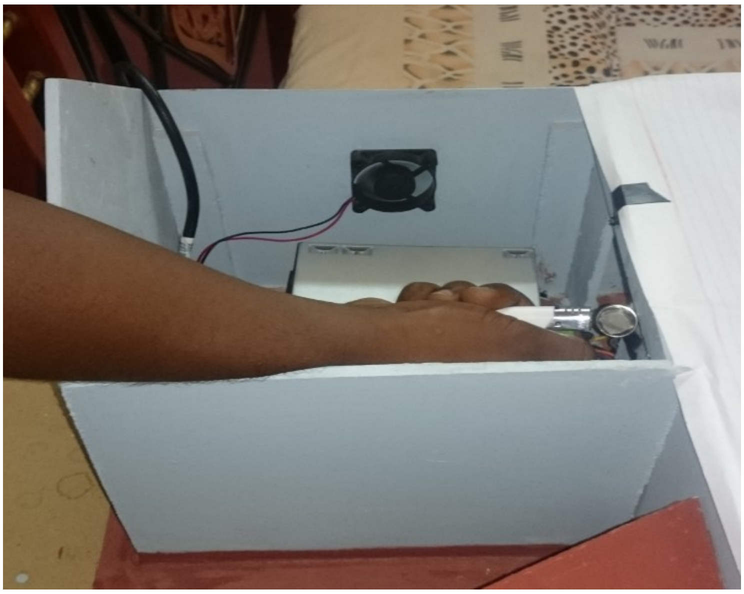

Figure 4.17: Suction fan turned on when gas leakage happen

Figure 4.18: Gas message to house owner

- **LM35 sensor**

The LM35 sensor installed in the kitchen to read the temperature as shown in Figure 4.19. When the kitchen temperature is very high it will turn on the alarm as shown in Figure 4.20 and send a message to the house owner says “YOUR HOUSE IS BURNING.. HURRY UP” as shown in Figure 4.21.

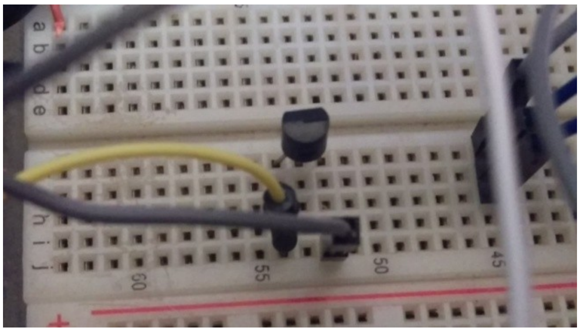

Figure 4.19: LM35 sensor

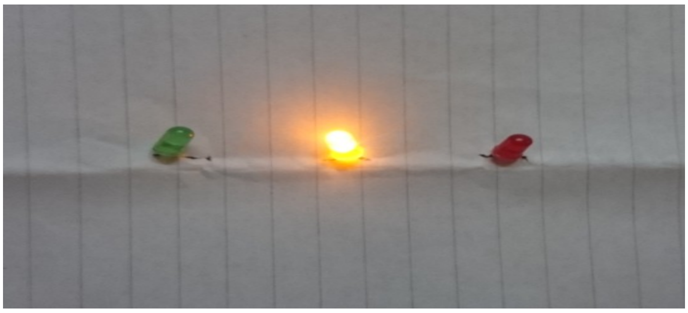

Figure 4.20: Alarm going on even if the system is deactivated

Figure 4.21: Burning message to house owner

CHAPTER FIVE

CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

From the works carried out through the project until the prototype is build, it can be conclude that the interface between Arduino and the 1Sheeld that stacked in another Arduino can make a smart security system that can be applied at many applications. In this project we applied this system at house. In this project we use sensors, these sensors connected to the circuit with two Arduino controllers -one of them connected to 1Sheeld- to make an action when the system hacked.

We use motion detector, gas and temperature sensors, when one of these sensors detect motion, gas leakage or overheat it will send signal to the Arduino to process it and make a suitable action. As a conclusion, the action that the Arduino controllers will take is to start alarm, send message to house owner's phone, capture picture and upload it to Dropbox so that the user can see it later. The system's user has the ability to control these actions by entering a password through a keypad unless the actions that relate to gas or temperature sensors.

5.2 Recommendations

To give a better perform we recommend:

- This project can be improved by making the user able to control the system via internet in case he is far away from house.
- It’s recommended to use a camera which can take videos instead of shots and can move automatically to the location of detected movement.

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APPENDIXES

Appendix A

- **Programming for Arduino**

```
//* is to validate password
//# is to reset password attempt
#include <Password.h>
#include <Keypad.h>
Password password = Password( "12" );
const byte ROWS = 4; // Four rows
const byte COLS = 3; //  columns
// Define the Keymap
char keys[ROWS][COLS] = {
  {'1','2','3'},
  {'4','5','6'},
  {'7','8','9'},
  {'*','0','#'}
};
```

```
byte rowPins[ROWS] = { 2,3,4,5 };// Connect keypad ROW0, ROW1,
ROW2 and ROW3 to these Arduino pins.
byte colPins[COLS] = { 6,7,8 };// Connect keypad COL0, COL1 and
COL2 to these Arduino pins.
float gaz;
int gazPin = 1;
float tempC;
int tempPin = 0;
// Create the Keypad
Keypad keypad = Keypad( makeKeymap(keys), rowPins, colPins,
ROWS, COLS );
void setup(){
   pinMode(9, INPUT);
 pinMode(10, INPUT);
pinMode(11, OUTPUT);
pinMode(12, OUTPUT);
pinMode(13, OUTPUT);
pinMode(0, INPUT);
  Serial.begin(9600);
  keypad.addEventListener(keypadEvent); //add an event listener for
this keypad
}
void loop(){
  keypad.getKey();
  gaz = analogRead(gazPin);
   tempC = analogRead(tempPin);
  tempC = (5.0 * tempC * 100.0)/1024.0;
         if(gaz>=800)
  {
digitalWrite (12, HIGH);
```

```
}
 if(tempC>=50)
{
 digitalWrite (12, HIGH);
}
 if ((password.evaluate()&&(tempC<=50)&&(gaz<=800))){
  digitalWrite (12, LOW);
      digitalWrite (13, LOW);
  }
 else
  {
 if(digitalRead (10)==HIGH)
 {
digitalWrite (12, HIGH);//BUZZER
digitalWrite (13, HIGH);//LAMP
 }
 if(digitalRead (9)==HIGH)
 {
digitalWrite (12, HIGH);
digitalWrite (13, HIGH);
 }
if(digitalRead (0)==LOW)
 {
digitalWrite (12, HIGH);
digitalWrite (13, HIGH);
 }
 }
}
void keypadEvent(KeypadEvent eKey){
  switch (keypad.getState()){
```

```
    case PRESSED:
          Serial.print("Pressed: ");
          Serial.println(eKey);
          switch (eKey){
            case '*': checkPassword(); break;
          case '#': password.reset(); digitalWrite(11,LOW );F break;
            default: password.append(eKey);
     }
  }
}
void checkPassword(){
  if (password.evaluate()){
   digitalWrite(11, HIGH);
//Add code to run if it works
  }else
  { digitalWrite(11,LOW );}
}
```

Appendix B

- **Programming for Arduino with the 1Sheeld**

```
#include <OneSheeld.h>
float gaz;
int gazPin = 1;
float tempC;
int tempPin = 0;
void setup()
{
 pinMode(3, INPUT);//IR
 pinMode(4, INPUT);//MOTION
 pinMode(5, INPUT);//PIR
 pinMode(8, INPUT);
pinMode(11, OUTPUT);
pinMode(12, OUTPUT);
 OneSheeld.begin();
}
void loop()
```

```
{
  gaz = analogRead(gazPin);
 tempC = analogRead(tempPin);
 tempC = (5.0 * tempC * 100.0)/1024.0;
     if(gaz>=800){
   SMS.send("+249924713274","THERE IS A LEAK IN THE GAS");
     digitalWrite (11, HIGH);
 }
 if(tempC>=50)
 {
   SMS.send("+249924713274","YOUR HOUSE IS BURNING..
RUN!!");
    digitalWrite (12, HIGH);
  }
    if((gaz<=800)&&(digitalRead (8)==HIGH)){      digitalWrite (11,
LOW);
    }
    if((tempC<=50)&&(digitalRead (8)==HIGH)){      digitalWrite (12,
LOW);
    }
 if (digitalRead (8)==LOW)
 {
 if (digitalRead (3)==HIGH)
     {
      SMS.send("+249924713274","SOMEONE IS WALKING AROUND
THE HALL...TAKE CARE");
          Camera.setFlash(ON);
   Camera.rearCapture();
         digitalWrite (12, HIGH);
 }
```

```
 if (digitalRead (4)==HIGH)
     {
       SMS.send("+249924713274","SOMEONE IS TRYING TO BREAK
YOUR WINDOW....HURRY UP");
          Camera.setFlash(ON);
   Camera.rearCapture();
             digitalWrite (12, HIGH);
 }
 if (digitalRead (5)==LOW)
     {
       SMS.send("+249924713274","SOMEONE IS TRYING TO
UNLOCK YOUR HOUSE LOCK...CHECK IT");
         Camera.setFlash(ON);
   Camera.rearCapture();
             digitalWrite (12, HIGH);
 }
 }
 if (digitalRead (8)==HIGH)
 {
        digitalWrite (12, LOW);
}
 if((tempC>=50) || (gaz>=800) || (digitalRead (3)==HIGH) ||
(digitalRead(4)==HIGH) || (digitalRead (5)==LOW))
 {
 delay(10000);
 }
}
```