Palestine Polytechnic University

College of Information Technology and Computer Engineering

Computer Engineering Department

KSPD a shortcut for Kids Savior as a Portable Device

Team members

Israa Abutair

Ghadeer Alshroukh

Supervised by

Dr. Amal Dweik

A project submitted in partial fulfillment for the Degree of Bachelor in Computer Engineering

May 2017

Acknowledgments

To

Our families and friends for supporting and encouraging us at our educational year and helping us to march forward.

To

Our teachers whom dedicated their precious time to educate us and enlighten our brains, we thank you, and a “thank you” word will never reward you all for your efforts.

To

Our supervisor DI. Amal Dweik for her time and priceless notes, you were a good guide in this phase of our project, we are sincerely grateful for your help.

And at last, we thank everyone who helped and advised us with our project.

We dedicate this project to you all.

Thank you, really thank you everyone.

Abstract

This project overcomes a serious issue we face in the life. It will help all parents to rescue their children's lives. When they are trapping inside a car for a long time, beside to saving lives when car had an accident.

The system receives different signals from sensors that are attached to it, and then processes inputs by the microcontroller. In simple words, the device measures the oxygen concentration inside a closed car; if there is someone in it. Which is detected by the motion sensor. Then it compares the readings of carbon dioxide sensor or temperature and humidity sensor to a predefined value. If it is low; then the device react to rescue trapped persons.

Beside to, if the system receives a signal from ADXL345 sensor , the car gets an accident . The system reacts to the situation and sends an emergency message to the civil defense.

The first step is investigating the existence of human beings by the motion sensor, if there is anyone. The second step; when the oxygen is getting low the device opens the driver window by a certain limit, and then sends a message to parents on the defined number of mobile. If they were too late, it sends a message to emergency containing the coordination of the car depending on GPS readings.

جدول المحتويات

Table of figures

Chapter 1

Introduction

In this chapter, we introduce the project, starting with overview of the problem, then motivation, a brief description of the project, our system methodology, objectives and goals, and then finally , we mentioned the literature review that related to our work.

1.1 Overview

All children have the right to be protected. They have the right to survive, to be safe, to belong, to be heard, to receive adequate care and to grow up in protective environment. A family is the first line of protection for children; For that there are lot of projects were invented for that roll. Devices watching and monitoring children inside home, when parents are not beside them. But what could happen when they are outside, in the cars for example and the parents were not beside them?

From here we came up with this idea, a device will monitor and keep safe the children inside the vehicles in absence of the responsible people.

"KSPD" a shortcut for Kids Savior as a Portable Device, and it is a device used in two emergency situations: the first one: when the carbon dioxide concentration is high inside of a closed car. The second situation if the heat is too high while there is children in it. The device saves them in three steps. First, reports the responsible person about the current situation by sending a text message to his or her cell phone using SIM808 shield and SIM formatting with required numbers. Second, the device opens the windows with a certain limit allowing air to enter in. Third, if parents take a long time to response after the message had been sent and the

device still working, in this case the device sent a message to the civil defense department as an emergency situation.

As a second emergency situation: when the car had an accident , the device has a useful sensor, called adxl354. The ADXL345 is a complete 3-axis acceleration measurement system . It measures both dynamic acceleration resulting from motion or shock and static acceleration, such as gravity, which allows the device to be used as a tilt sensor. When the sensor reads a different 3-axis measurements , that changed in a fast way, beside to a dynamic acceleration . that means an accident happened to the car , and in this situation the device text a civil defense with the local coordination of the car to rescue them.

In other words, this project, will serve as a supervisor, keeps watching the car situation while there children in vehicles with absence of their parents, keeping them on touch in case something wrong happened. Beside to the accident cars .

1.2 Motivation

We will reflect a lot of what we have learnt from the courses that we took in the college ;computer system engineering. Such as hardware design related courses as in embedded systems course. As well as software related courses object oriented and data structure courses.

1.3 Brief Description of the project

KSPD works as follows: when you leave your car, leaving a child in it, and the device is in working position, the operations begin when the car key is taken out from the steering wheel, because the device formatted to work in two cases , when the car is turned on and when it is turned off. The device starts reading the measurements of the carbon dioxide sensor and the temperature sensor periodically every three minutes. In addition, to the motion sensor which watching the motion of human beings. In case of the carbon dioxide sensor readings increase above a certain value (400 ppm) [10], or the temperature sensor readings increase above a threshold(45 c) [11], and the motion detect a movement in car, the device starts working in an

emergency situation, and children lives might be in danger. The device sends a signal to start the motor connected to the window, making it open for a certain limit allowing the air to come through, until the carbon dioxide concentration decreases back to the normal value, and the heat decreases .

The device sends at first message to the responsive person using the GSM shield, parents or accompanying person . In case parent's response takes too long (4 to 6 minutes; time death of the brain when the oxygen is severed) [13] . The device texts the civil defends as a second plan by a message , contains the coordination of the car location that the GPS shield detected them, to help civil defense reaching the car in the accident place.

As a second case when the car had an accident. The ADXL345 sensor measures both dynamic acceleration resulting from motion or shock and static acceleration, such as gravity. When the sensor reads a different 3-axis measurements , that changed in a fast way, beside to a dynamic acceleration . that means an accident happened to the car , and in this situation the sensor sends a signal to text a civil defense with message shows the local coordination of the car by using the GPS shield.

1.4 Methodology

In this section we introduce the main methodology for our work that mainly organized as follow:

Related works

When we found this idea to be our project, we start researching for similar projects on the internet for universal and local projects. we start reading them and understanding their operating mechanisms and make them as a reference for our project when we will start to invention it. Then we start looking for the needed components on the internet, and by asking our teachers and asking them for their advices and offering their help.

Communication skills

We successfully approved our skills as working in a team ,and cooperating to obtain the result of the construction of this project. Beside to improving our skills in English language, by writing this documentation.

System description

The first step is investigating the existence of human beings by the motion sensor, if there is any one. When the carbon monoxide is getting high the device opens the driver window by a certain limit, and then sends a message to parents on the defined number. If they were too late, it sends a message to emergency containing the coordination of the car depending on GPS readings.

1.4.1 Project goals and objectives

The project intents to keep a normal concentration of oxygen and temperature in the car and monitors whenever someone in it by the motion sensor . Through the periodic measurements readings of both sensors, when the readings change to another reading, it starts to work. As an emergency situation, the goals of our project can be stated as a:

Personal objectives:

- The ability of enhancement team work.
- To march the market with a useful product we could sell it .

Project objectives:

- Reduce the percentage of children death and suffocation cases inside closed cars.
- Reduce the percentage of adults death in car accidents.
- Help parents to be aware for their children presence inside the car after a while in case they forgotten them.
- Locate the car in case of an emergency by GPS module.

- Contact with parents in case the oxygen percentage is no longer appropriate for the children to stay in the car.

1.4.2 Literature Review

If we looked back to the origin of this idea we will find projects done earlier in 1999 year. As a beginning under the title "Vehicle having a thermal protection arrangement for toddlers and pets". [1] This invention has to work in general with a system controlling power window and sunroof of a vehicle for protecting toddlers, pets, and other incapacitated living beings, from ill effects of high and low temperatures. An aspect of the invention relates to the lowering and raising of a power window and opening and closing of a sunroof both to pre-defined positions to prevent the vehicle interior to become too hot or too cold. In addition, this invention is related to an emergency arrangement for alerting the vehicle driver in case of thermal danger to the well-being of those left unattended in the vehicle. Advantageously, this invention also lengthens the operational life span of electronic and mechanical components near or in the vehicle interior.

Also there is another project created before couple years by a senior group of the macatronics department from Palestine Polytechnic University in College of Architecture. [2] The main idea of their project is to save children from suffocating and getting a heat stroke. They developed it to work on the solar cells to provide energy to run the air conditioner, therefore providing the vehicle with oxygen and to decrease the arising temperature from the sun. What differs our device it independents of the car power and we can say that it is partially portable and easy to add to any vehicle, the only condition is that the car model is higher than 2010 model. For it contains the "cut-out" piece that will help us to control the front-driver window. Our project will certainly be different for satisfying the new age requirements and prevents a lot of serious accidents that may cause death.

Chapter 2

Problem Statement

In this chapter we will introduce the problem statement of this project, starting with the problem analysis that describing the needs of this project, next the list of requirements, and at last the expected results to our project.

2.1 Problem analysis

As usual in our daily life, with a lot of pressure works that facing the parents and the adults. Appearance the needs to finish some works outside, as in some institutions and malls and public places. Forcing the parents to accompany the children with in car, and leaving them into it. As for reasons that may be they are sleep or for their thoughts they will not get to late, and back as fast as soon. Unfortunately, the opposite could happen, leading regrettably the accidents for their children, for getting busy and forgetting them for a long time without supervisor .

The device function comes to handle these situations. The device works as a rescue device that parents will be encouraged to own, it playas the protector role in cars while parents or responsible person absent. The other function it can dose when an accident happened to the car , it text the civil defense to save the victims of the accident.

The buyer of this device has to use a SIM to connect and he will enter a phone number or numbers as other person and the emergency number to call when needed. after he assembles all that, he becomes ready to put it on the car and clicking the start button.

2.2 List of requirements:

System requirements can be summarized as:

Functional requirements:

- Breadboard and wires bundle.
- ADXL345 to detect accidents .
- Motion sensor to detect existing the human beings .
- Two arduinos to connect the system with each other.
- Carbon dioxide sensor to measures the concentration of it.
- Temperature and humidity sensor to measure the heat and the humidity in the air .
- SIM808 GPRS+GSM/GPS shield to connect with the client cellular and locating the position.

Nonfunctional requirements:

- The speed of sending message takes 0.2 seconds .
- The security that the device provided , it opens the window driver for 2 cm, and closes it after 3 minutes.
- The reliability at sending the message to the right contact , which saved on SIM .

2.3 Expected results

The results that we expect to attain are:

- A successful machine that works in emergency situations.
- A portable device that easy to use and to carry and attractive to buy.
- Helps at preventing the occurrence of death.

Chapter 3
Background

3.1 Overview

In this chapter we will give a detailed description of the device hardware and software components and at last we will demonstrate design specifications and constrains.

3.2 Hardware Components

In this section we will give a brief description about the hardware components used to build and develop our device, we will simply talk about their contributions and tasks.

3.2.1 Arduino MEGA 2560.

A microcontroller includes a processor, memory, and peripherals, it is an open-source physical computing platform based on a simple I/O board and a development environment that implements the Processing/Wiring language. Arduino can be used to develop stand-alone interactive objects or can be connected to software on your computer.

It has 70 digital input/output pins (of which 15 can be used as PWM outputs and 16 can be used as analog inputs), a 16 MHz resonator, a USB connection, a power jack, an in-circuit system programming (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 an AC-to-DC adapter or battery to get started.

It is the basic component in our device it reads the inputs of the sensors connected with it and acts depending on the information provided in programming, and it is powered by a rechargeable battery that is recharged by the car's main battery, either by a USB to the car charger or by a wire connected directly to the car's battery. [2]

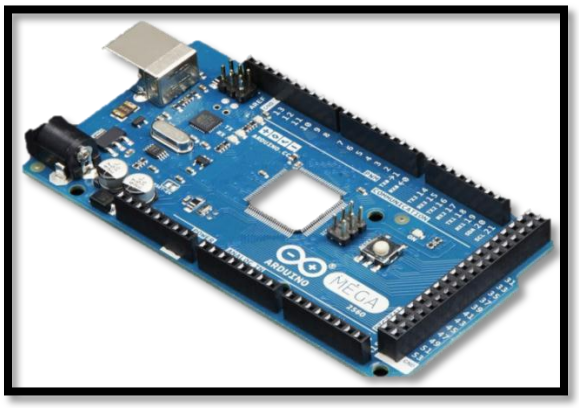


Figure 2.1 Arduino MEGA

3.2.2 SIM808 GPRS/GSM+GPS shield

SIM808 GPRS/GSM+GPS Shield is a GSM and GPS two-in-one function module. It is based on the latest GSM/GPS module SIM808 from SIMCOM, supports GSM/GPRS Quad-Band network and combines GPS technology for satellite navigation. It has high GPS receive sensitivity with 22 tracking and 66 acquisition receiver channels. The module is controlled by AT command via UART and supports 3.3V and 5V logical level.[٣]

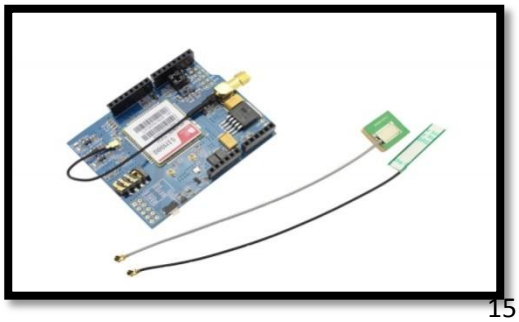


Figure 2.2 SIM GPRS+GSM/GPS Shield

3.2.3 PIR motion sensor module

PIR sensors allow you to sense motion, almost always used to detect whether a human has moved in or out of the sensors range which will detect the motion of the person using the person body heat. They are small, inexpensive, low-power, easy to use and don't wear out.

Figure 2.3 PIR motion Sensor

PIRs are basically made of a pyro, which can detect levels of infrared radiation. Everything emits some low level radiation, and the hotter something is, the more radiation is emitted. The sensor in a motion detector is actually split in two halves. The reason for that is that we are looking to detect motion (change) not average IR levels. The two halves are wired up so that they cancel each other out. If one half sees more or less IR radiation than the other, the output will swing high or low. [4]

3.2.4 MG811 Carbon dioxide senor

Carbon dioxide sensor module (with analog signal, TTL level, output signal temperature compensator) ,One size: 32 mm X 22 mm X 30 mm L * W * H , the main chip: LM393 carbon dioxide gas detection probe and the working voltage: DC 6 volts .There are signs teaching; signal pairs (output analog and output TTL levels); TTL detects the correct signal is low (low signal

level when the power output directly to the microcontroller). analog output (0 ~ 2 volts / 0-4 volt) output voltage selection, starting hair 0-2 volt, highly sensitive carbon and good elixirs, the test can be designed plugs for easy. It is suitable for monitoring the concentration of carbon dioxide, carbon dioxide gas, the test gas concentration range: 0 to 10000ppm [5]

Figure 3.4 Gas Sensor

3.2.5 Arduino uno

Arduino Uno Microcontroller Board is based on the Atmel ATmega328 8-bit Microcontroller . Arduino Uno features 14 digital input/output pins (six of which can be used as PWM outputs), six analog inputs, and a 16MHz quartz crystal. Uno also includes a USB connection. This Arduino microcontroller board contains everything the user needs to support the microcontroller. The user can get started by connecting the Uno to a computer with a USB cable or by powering it with an AC-to-DC adapter or battery. The Uno can be programmed with Arduino Software. The ATmega328 on the Uno comes preprogrammed with a boot loader that allows the user to upload new code to the microcontroller without using of an external hardware.

Arduino Uno differs from preceding boards in that it does not use the FTDI USB-to-serial driver chip. This board instead features the Atmega16U2 programmed as a USB-to-serial converter. [6]

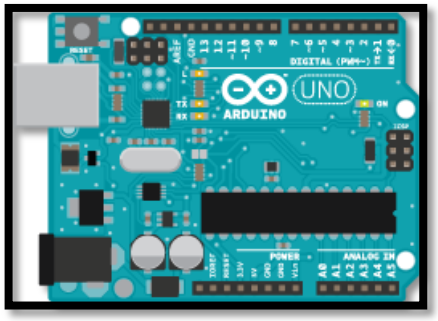
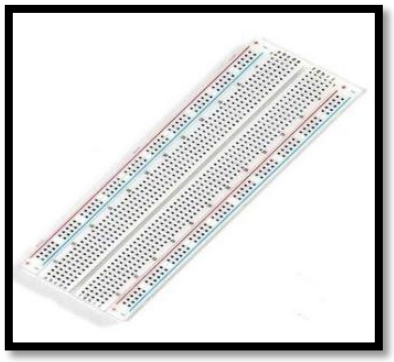


Figure 2.5 Arduino UNO

3.2.6 Full Sized Breadboard and Jumper Wire

Breadboard is a way of constructing electronics without having to use a soldering iron. Components are pushed into the sockets on the breadboard and then extra 'jumper' wires are used to make connections. It has two power rails on the sides to allow more than one power level. With a total of 830 ties in points, all pins are spaced by a standard 0.1″ (2.54mm). It has a self-adhesive on the back and also interlocking parts, so you can hook as many together as you'd like.



Jumper Wires: Wires made especially for breadboard connections it's much easier and faster than stripping your own solid core wires .Makes Breadboarding super-fast. [7]

Figure 2.6 (a) BreadboardFigure 2.6(b) Jumper wire

3.2.7 Lithium batteries and car charger

Lithium batteries 3000mA are used in this project to provide the Arduino with the power it needs and also to power up the motor that already exists in the car when the cars battery is empty. To power the Arduino we need two batteries and two more for the motor. It is 3.7V 3000mAh Li-Ion Battery Pack, made of 2 pieces of 3.7V 1500 mA (PL325085) batteries with Built in Protection IC (PCB) to avoid battery from over charge and over discharge, with a JST 3 pins connector (EH-3P) and 10K Thermistor included. [8]

Figure 2.7(a) Lithium batteries

The car charger needed for the device is available and contains USB ports with different ambers, it works as the charger of the Arduino batteries and will always charge as long as the USB connected.

Figure 3.7(b) car charger

3.2.8 DHT22 temperature and humidity sensor

DHT22 output calibrated digital signal. It applies exclusive digital-signal-collecting-technique and humidity sensing technology, assuring its reliability and stability. Its sensing elements is connected with 8-bit single-chip computer. Every sensor of this model is temperature compensated and calibrated in accurate calibration chamber and the calibration-coefficient is saved in type of programming in OTP memory, when the sensor is detecting, it will cite coefficient from memory. Small size and low consumption and long transmission distance(100m) enable DHT22 to be suited in all kinds of harsh application occasions. Single-row packaged with four pins, making the connection very convenient. [9]

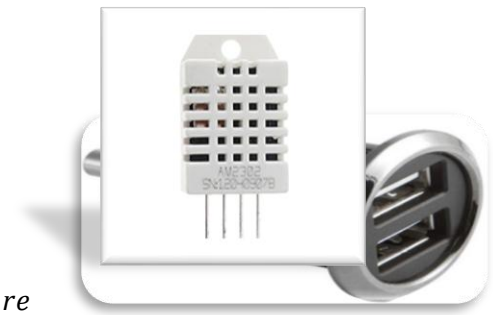


Figure 3.8 temperature and humidity sensor

3.2.9 ADXL345 Sensor

The ADXL345 is a small, thin, low power, 3-axis accelerometer with high resolution (13-bit) measurement at up to ±16 g. Digital output data is formatted as 16-bit twos complement and is accessible through either a SPI (3- or 4-wire) or I2 C digital interface.

The ADXL345 is supplied in a small, thin, 3 mm × 5 mm × 1 mm, 14-lead, plastic package. Several special sensing functions are provided. Activity and inactivity sensing detect the presence or lack of motion and if the acceleration on any axis exceeds a user-set level. Tap sensing detects single and double taps. Free-fall sensing detects if the device is falling. These functions can be mapped to one of two interrupt output pins. An integrated, patent pending 32-level first in, first out (FIFO) buffer can be used to store data to minimize host processor intervention.

The ADXL345 measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock. Its high resolution (4 mg/LSB) enables measurement of inclination changes less than 1.0°. [10]

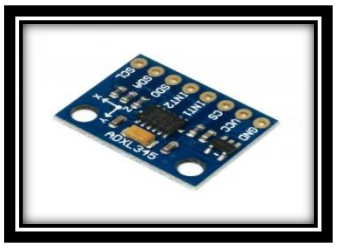


Figure 3.9 ADXL345 Sensor

3.3 Software components

This part will talk about the software we are intending to use to help operating the device correctly.

3.3.1 Arduino Software IDE

Arduino integrated development environment (IDE) is an open source software which is cross-platform, the open-source (IDE) makes it easy to write code and upload it to the board. It runs on

Windows, Mac OS X, and Linux. The environment is written in Java and based on Processing and other open-source software. This software can be used with any arduino board. An arduino C/C++ sketch consists of two functions that are compiled and linked with a program stub main () into an executable cyclic executive program (setup () and loop ()) functions, this software is used to program the arduino and install all requirements to it.

3.4 Specifications and constrains

In this section we will talk about design specifications, constrains and limitations that should be provided and that may face us.

3.4.1 Design Specifications.

- The device will be built in a simple way , clear to all team members or developers. It should depends on the microcontroller to guide all devices parts and make sure they work probably.
- All sensors should be reliable and ready to work in real time.

3.4.2 Design Constrains

- Use of inexpensive products and devices as much as possible.
- the problem in generalization to connect the device in the car.

Chapter 4
Introduction

4.1 Overview

This chapter discusses the design option of hardware and software components of our project, and conceptual design of the system such as block diagram and the flow chart of the hardware components of the system.

4.2 Brief Description of the System

Our device receives a set of signals, such as the carbon dioxide sensor and the motion sensor and the temperature and humidity sensor beside to the adxl345 sensor, and then sends them to the arduino piece, if the carbon dioxide ratio is higher than the limit and there was a person in the car, the Arduino send a signal to the car window to open for a certain amount allowing air in, and send a message to parents stored number notifying them to watch out for their kids in case they have forgotten them, the same case happing when the temperature ratio increased above the limit . then after a certain period when the carbon dioxide concentration and temperature return to normal the window is closed, After a period of time if the parents did not arrive, the device sends a message to the civil defense containing the cars location. Beside to another case when a

car accident happen , the adxl345 sensor is measuring the accident and send a message to the civil defense carrying the coordination of accident location.

4.3 Design Options

In this section we will demonstrate the hardware components design and role.

4.3.1 Hardware Design

As mentioned, the device contains an carbon dioxide sensor, motion sensor, temperature and humidity sensor and adxl345 sensor, SIM808 GSM/GPRS+GPS module, rechargeable batteries, and an two arduinos, we will discuss each here.

4.3.2 Arduino Microcontroller

Arduino receives data from carbon dioxide sensor and motion sensor and temperature and humidity sensor. It then analyzes the data and makes the decision to send a message to the parents and open the car window. After a specified time, it checks the carbon dioxideratio beside to temperature ratio . If it is normal it closes the window, after a long time passed when parents did not respond a message to civil defense is sent.

We have two pieces of arduino:

- Arduino MEGA 2560.
- ArduinoUno

Advantages of arduino mega 2560:

- Has many more digital and analog pins.
- Memory size is larger.
- Easy to use.

Disadvantages of arduino mega 2560:

- Higher cost.

Advantages of arduino uno:

- Ready to use structure .
- Big library it has.
- Effortless functions.

- Large community on website.

Disadvantages of arduino uno:

- Small in size.
- High in cost.
- Complex and easy to use.

4.3.3 SIM808 GSM/GPRS+GPR Shield

This shield allows you to install SIM card to Arduino chip to store the numbers on it, make calls, send messages, and also supports internet access, and detecting the location.

Advantages

- Quad – band 850/900/1800/1900MHz – connect onto any global GSM network with any 3G SIM
- Fully- integrated GPS
- Make and receive voice calls using a headset or an external 32Ω speaker + electrets microphone
- Send and receive SMS message
- AT command interface with "auto baud" detection
- Send and receive GPRS data (TCP/IP,HTTP, etc.)
- Available anywhere, anytime and within mobile network coverage.
- High speed data transfer compared to current speeds.

4.3.4 PIR motion sensor

The sensor detects the presence of children inside the car at an angle of 110 by the thermal radiation coming out of the child's body.

Advantage

- Can measure for 20 meters
- Depends on infrared radiation
- The delay in reading is 5 seconds
- Feel the motion at an angle of 110
- Reading and distance can be controlled by two resistors

Disadvantages

- It may be inaccurate if the child stood still or was asleep and didn't move.

4.3.4.1 Full sized breadboard and jumper wire

The breadboard is a very useful component, it is used without having to use a soldering iron. Components are pushed into the sockets on the breadboard and then extra 'jumper' wires are used to make connections, the only problem that might face us that the wires might not give us full connectivity, and the breadboard may limit our hardware component, and make them all loosely coupled.

4.3.4.2 Lithium batteries and a car charger

Those batteries are mainly used to charge the Arduino for it needs 5-12 volts so we will connect it with two batteries of this kind each 3000 mA, and we will need the microcontroller to supply the motor driver, instead we will add another two batteries to do that job, their disadvantage is the high temperature that is produced by them as for they operate for a long time.

As for the car charger it's connected to the Arduino to provide power when the car is running the only disadvantage that the car charger may not suite the Arduino shield.

4.3.4.3 ADXL345 sensor

The ADXL345 is well suited to measures the static acceleration of gravity in tilt-sensing applications, as well as dynamic acceleration resulting from motion or shock. Its high resolution (4 mg/LSB) enables measurement of inclination changes less than 1.0 degrees.The ADXL345 is a small, thin, low power, 3-axis MEMS accelerometer with high resolution (13-bit) measurement at up to +-16 g. Digital output data is formatted as 16-bit twos complement and is accessible through either a SPI (3- or 4-wire) or I2C digital interface.

4.1.3.7 DHT22 sensor

The AM2302 digital temperature and humidity sensor is a digital device providing a calibrated temperature and humidity output .It uses a dedicated digital module with advanced temperature and humidity sensor technology.Ultra-small size, low power consumption, and a signal transmission distance up to 20 meters, make it a good choice for a wide range of applications and demanding applications.

4.1.3.8 mg811 sensor

The MG-811 sensor is a cell structured 6 pins module that has a very small output range with the change in CO2 level. As the output signal is very small, it needs to be amplified in order to

have clear readings. Thus the sensor module consists of signal conditioning circuit and the heating circuit. It has the principal advantage of a very low energy consumption, and can be reduced in size to fit into microelectronic-based systems. On the downside, short- and long term drift effects as well as a rather low overall lifetime are major obstacles .

4.3.5 Software Design

We use one programming software for programming the Arduino, as described below.

Arduino Software: The open-source Arduino Software (IDE) makes it easy to write codes and upload them to the board. It runs on Windows. The environment is written in java and based on processing and other open-source software. It will be used to write codes for driving the component of the kit to be able to function.

4.4 Detailed Design

4.4.1 System Diagrams

Figure 4.1 shows the block diagram of the system, and how hardware components communicate with each other in Figure 4.2.

Block Diagram

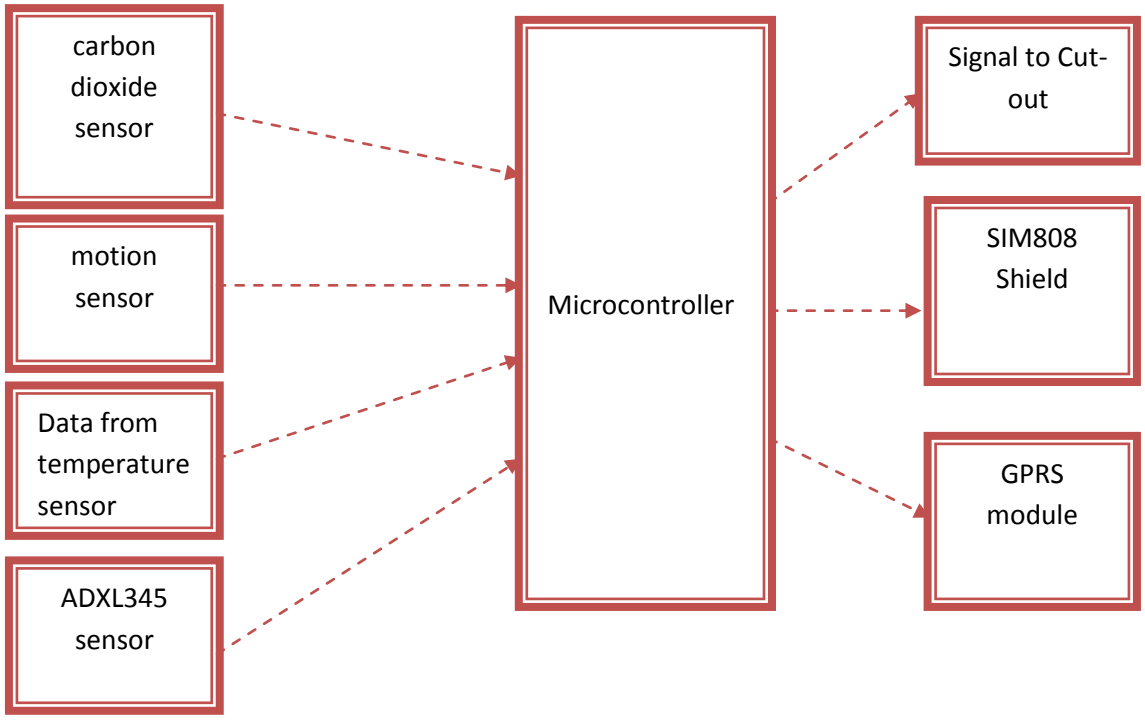
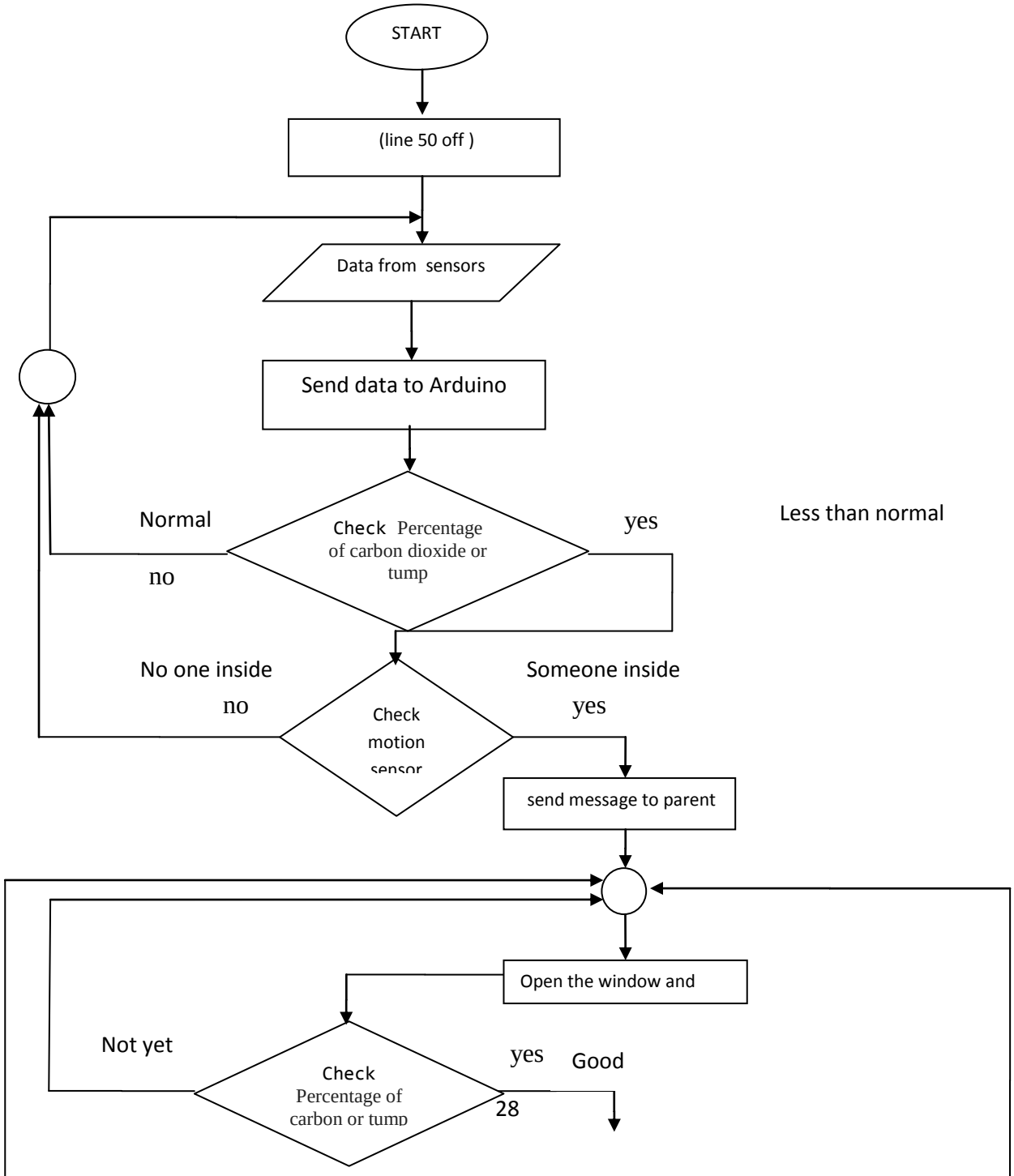


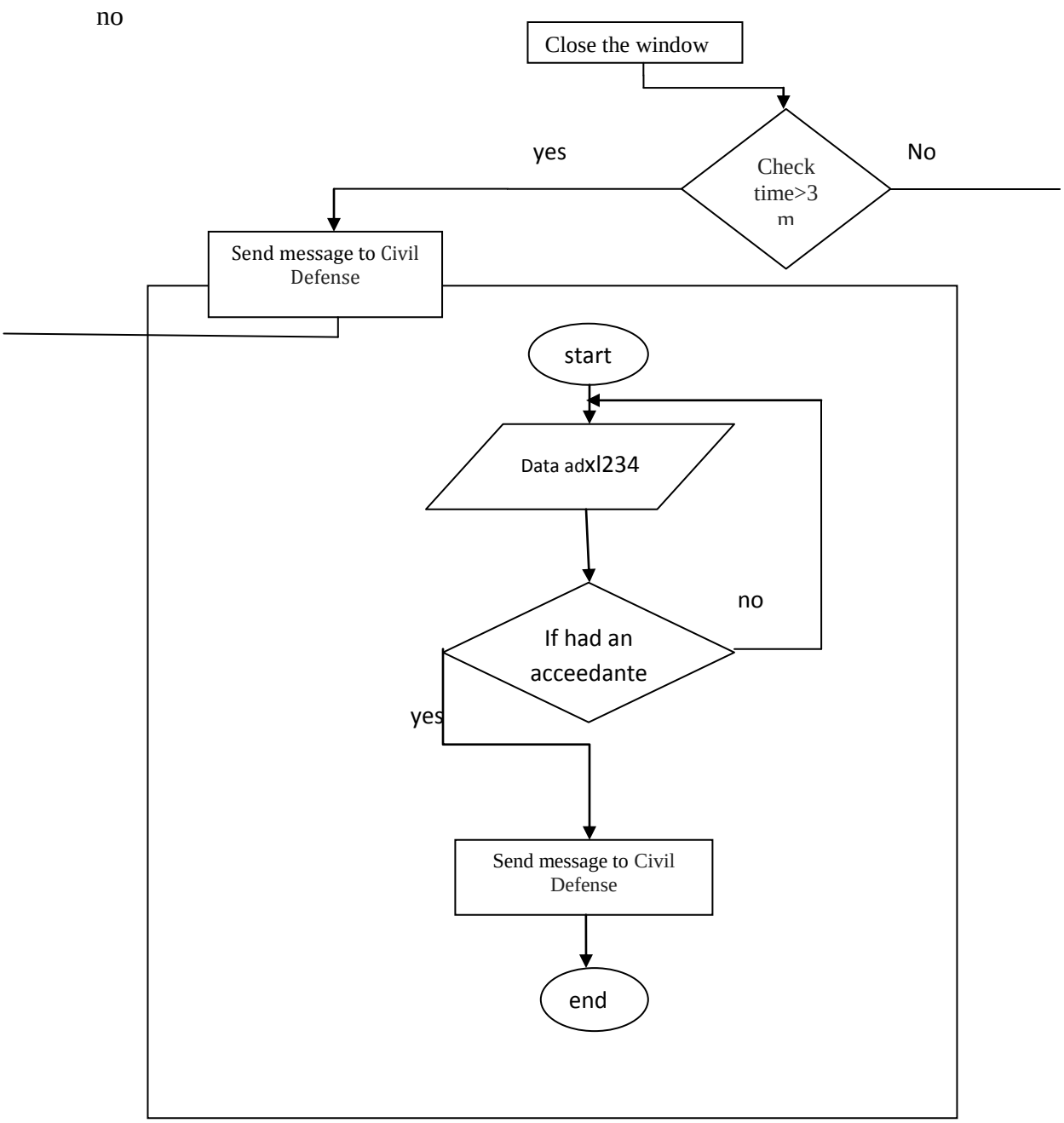
Figure 4.1System Block Diagram

Figure 4.1 is the block diagram for the system. It shows the main building blocks of the system and how they communicate. It shows at the beginning how to move data from sensors, carbon dioxide and motion , temperature and humidity, adxl345 sensors to the Arduino panel. Then the microcontroller process the incoming data to make a decision to allow or not the opening of the window through the "cut-out" that is located in the front seat door in the car, by analyzing the incoming data and comparing them with the set up data. After the reading and comparison operations the Arduino send two signals, one to the "cut-out" component, which is connected to the bipolar stepper motor in the cars window, making the window open for a certain amount while a counter is initialized in the Arduino.

The second block is describing the SIM808 shield that will work on sending a message to parents using the saved number after a long time is passed while their kids in the car, of course this time is calculated by a timer in the Arduino , beside to send a message to civil defense after a long time by using the GPRS and GPS in the shield which the detecting the coordination of the local car.

The third block shows the GPS module that determines the location of the car and send the coordination to the civil defense when the car get crushed .


START
(line 50 off)
Data from sensors
Send data to Arduino
Normal
Check Percentage of carbon dioxide or tump
yes
Less than normal
no
No one inside
Someone inside
no
Check motion sensor
yes
send message to parent
Open the window and
Not yet
Check Percentage of carbon or tump
yes
Good



Figure(b)

In the above flow charts we describe our devices operations, they are separated because one of them is dedicated to check the batteries, one to check if an accident happened to the car and one is for the whole system, in figure (a) the system starts by reading data from sensors and sending it to the microcontroller for processing, the carbon dioxide sensor measure the carbon

dioxide concentration in the air, and then sends a signal to the microcontroller to process the result and to compare if the concentration is normal or not, or Take the reading from the heat sensor and send it to the processor to be compared with the stored value ,then if motion sensor detects any motion it sends a signal that there is someone in the car.
If both conditions are checked then the microcontroller send a signal to the "cat-out" to open the window by a certain amount letting air in, while sending a message to parents to notify them that their kids are still in the car, then the microcontroller initiate two timers, one for the window to open for a given amount, and one to count from the time the message was sent to parents.

During this time the carbon dioxide sensor still reads the concentration of carbon dioxide in air

and when it returns to normal, it gives back another signal to the microcontroller to close the window, after closing the window it calculate the time and if it is too long then send a message to emergency containing the coordination, the end.

We detected the timer to send is 3 minutes

In the figure (b) data are taken from the ADXL345 sensor to measure the acceleration and send it to the microprocessor, if the car is involved in an accident, there will be a significant change in acceleration so the SIM808, locate the car and send its coordinates to the Civil Defense.

Chapter 5
Validation And Testing

5.1 Overview

5.1 In this chapter we will show and explain how we tested KSPD system and how we operated each sensor. Arduino code validation plus the whole system validation.

5.1 Sensors validation

We Validated each sensor alone , by connecting it to the shield then to Arduino Mega then applying the correct code. Finally results appeared on the serial monitor.

5.1.1 PIR sensor validation

Figure 5.9 shows how we connected the sensor to shield over an Arduino .Note that we can see the readings of this sensor on the screen of the laptop as in figure 5.10.

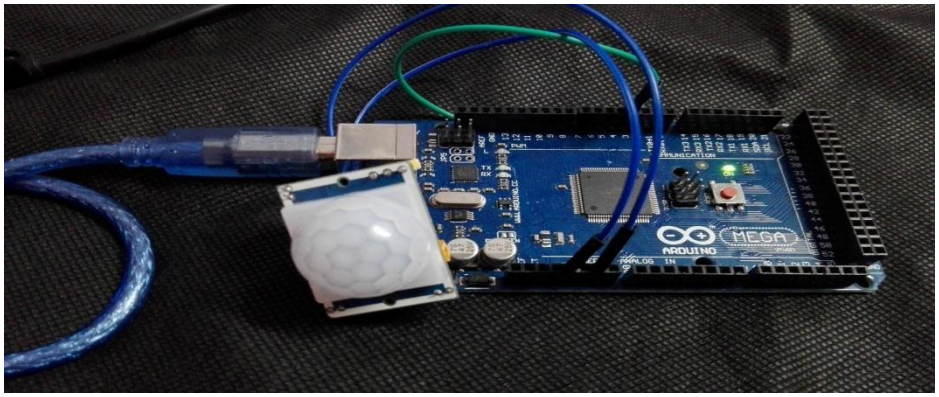


Fig 5.9: PIR sensor motion connection

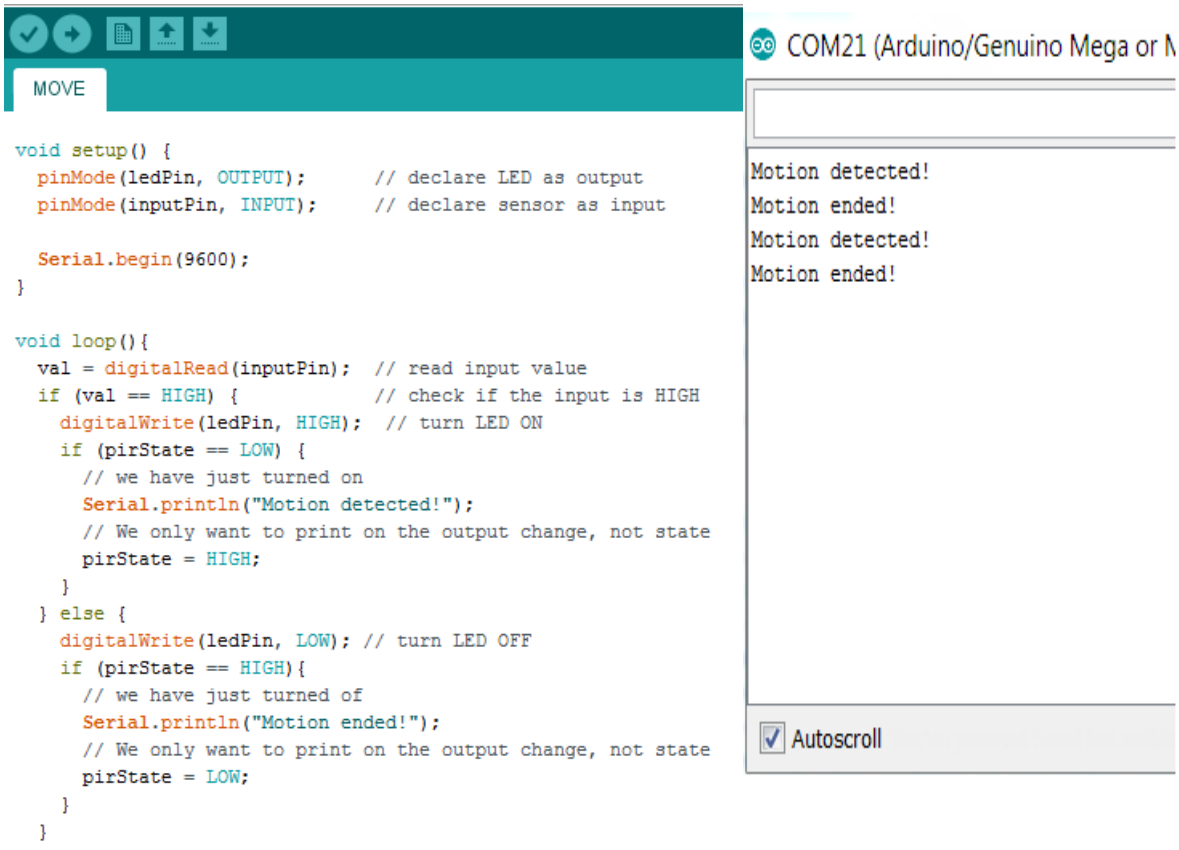


Fig 5.10 PIR sensor validation code and result

5.1.2 temperature and humidity sensor validation

Figure 5.11 shows how we connected the sensor to breadboard over an Arduino mega. Note that you can see the readings of this sensor on the screen of the laptop as in figure 5.12.

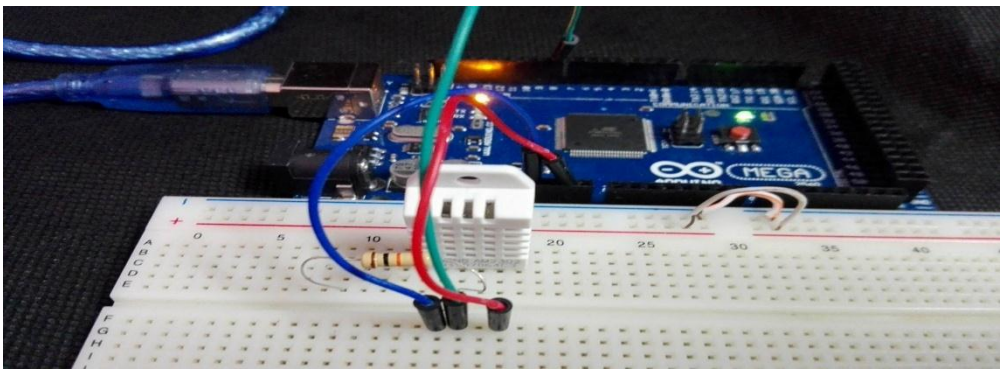


Fig5.11: DHT22sensor connection

- Here we calibration to detect value of 35°C as high.

```
7RAR
 */
/*
 * You can find the DHT Library from Arduino official website
 * http://playground.arduino.cc/Main/DHTLib
 */

#include <dht.h>
#define dataPin 8 // Defines pin number to which the sensor is connecte
dht DHT; // Creats a DHT object
void setup() {
  Serial.begin(9600);
}
void loop() {
  int readData = DHT.read22(dataPin); // Reads the data from the sensor
  float t = DHT.temperature; // Gets the values of the temperature
  float h = DHT.humidity; // Gets the values of the humidity

  // Printing the results on the serial monitor
  Serial.print(" = درجه الحراره");
  Serial.print(t);
  Serial.print(" *C ");
  Serial.print(" = الرطوبه ");
  Serial.print(h);
  Serial.println(" % ");

  delay(2000); // Delays 2 secods, as the DHT22 sampling rate is 0.5Hz
}
```

```
COM21 (Arduino/Genuino Mega or Mega 2560)
24.90= درجه الحراره *C 56.50= الرطوبه %
25.00= درجه الحراره *C 57.60= الرطوبه %
24.90= درجه الحراره *C 57.20= الرطوبه %
24.90= درجه الحراره *C 55.90= الرطوبه %
24.90= درجه الحراره *C 54.70= الرطوبه %
24.90= درجه الحراره *C 53.80= الرطوبه %
24.80= درجه الحراره *C 52.90= الرطوبه %
24.80= درجه الحراره *C 52.20= الرطوبه %
24.80= درجه الحراره *C 51.70= الرطوبه %
24.70= درجه الحراره *C 51.30= الرطوبه %
24.70= درجه الحراره *C 50.90= الرطوبه %
24.70= درجه الحراره *C 50.60= الرطوبه %
24.60= درجه الحراره *C 50.30= الرطوبه %
24.60= درجه الحراره *C 50.10= الرطوبه %
24.60= درجه الحراره *C 49.80= الرطوبه %
24.50= درجه الحراره *C 49.60= الرطوبه %
24.50= درجه الحراره *C 49.50= الرطوبه %
Autoscroll
```

Fig 5.12: DHT22Validation code and results.

5.1.3 carbon dioxide sensor validation

Figure 5.13 shows how we connected the sensor to an Arduino mega with external power supply to provide the sensor voltages. we can see the readings of this sensor on the screen of the laptop as in figure 5.14.

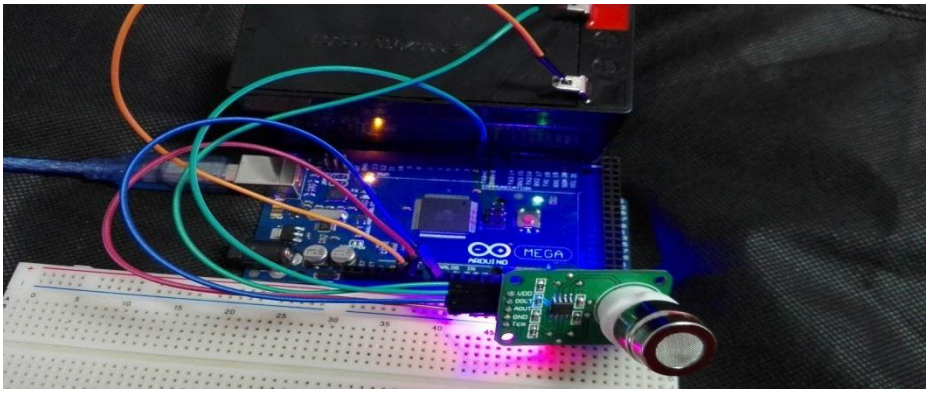
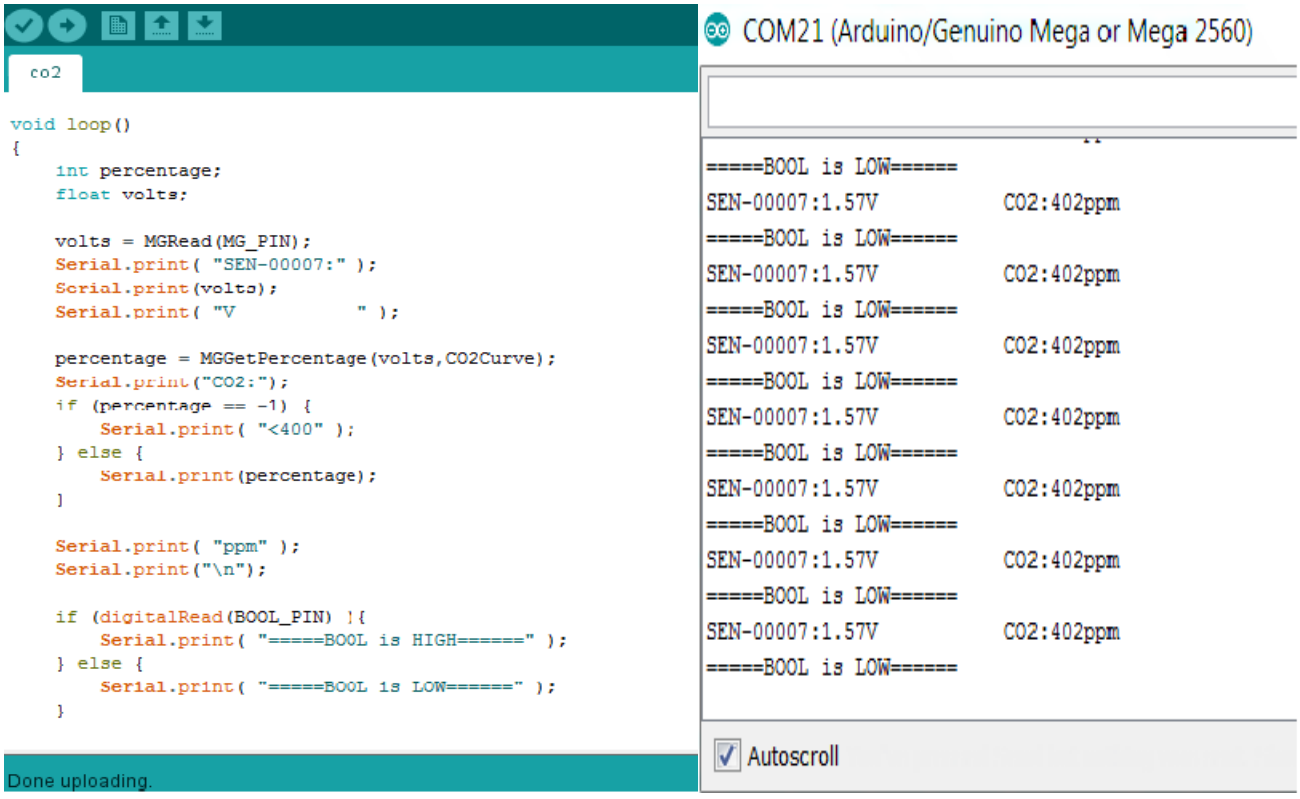


Fig 5.13: MG811 sensor connection

- here we had done a calibration to detect the 400 p.p.m as low and 1000 p.p.m as high.



```
co2

void loop()
{
    int percentage;
    float volts;

    volts = MGRead(MG_PIN);
    Serial.print( "SEN-00007:" );
    Serial.print(volts);
    Serial.print( "V           " );

    percentage = MGGetPercentage(volts,CO2Curve);
    Serial.print("CO2:");
    if (percentage == -1) {
        Serial.print( "<400" );
    } else {
        Serial.print(percentage);
    }

    Serial.print( "ppm" );
    Serial.print("\n");

    if (digitalRead(BOOL_PIN) ){
        Serial.print( "=====BOOL is HIGH======" );
    } else {
        Serial.print( "=====BOOL is LOW======" );
    }

Done uploading.
```

```
COM21 (Arduino/Genuino Mega or Mega 2560)

=====BOOL is LOW======
SEN-00007:1.57V          CO2:402ppm
=====BOOL is LOW======
SEN-00007:1.57V          CO2:402ppm
=====BOOL is LOW======
SEN-00007:1.57V          CO2:402ppm
=====BOOL is LOW======
SEN-00007:1.57V          CO2:402ppm
=====BOOL is LOW======
SEN-00007:1.57V          CO2:402ppm
=====BOOL is LOW======
SEN-00007:1.57V          CO2:402ppm
=====BOOL is LOW======
SEN-00007:1.57V          CO2:402ppm
=====BOOL is LOW======

Autoscroll
```

Fig 5.14: MG811 Validation code and results.

5.2.4.ADXL sensor validation

Figure 5.15 shows how we connected the sensor to breadboard and then to Arduino mega. we can see the readings of this sensor on the screen of the laptop as in figure 5.16.

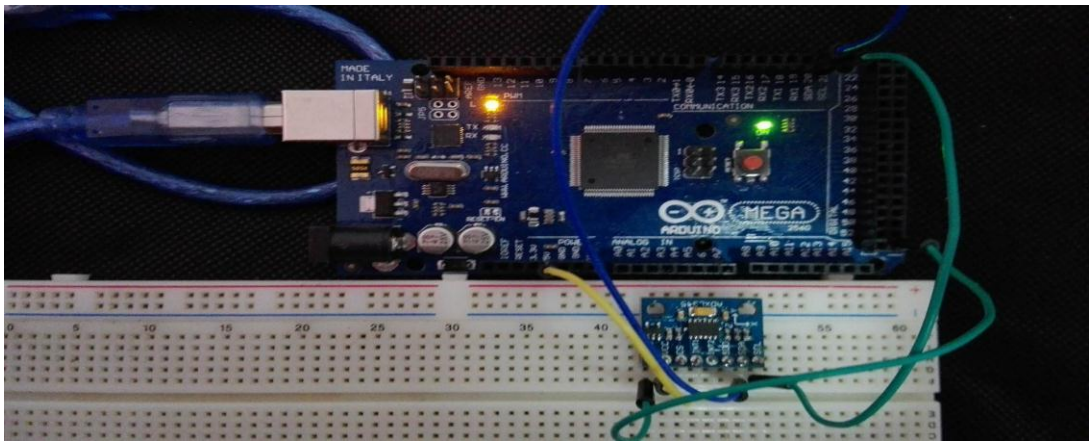


Fig 5.15: ADXL sensor connection

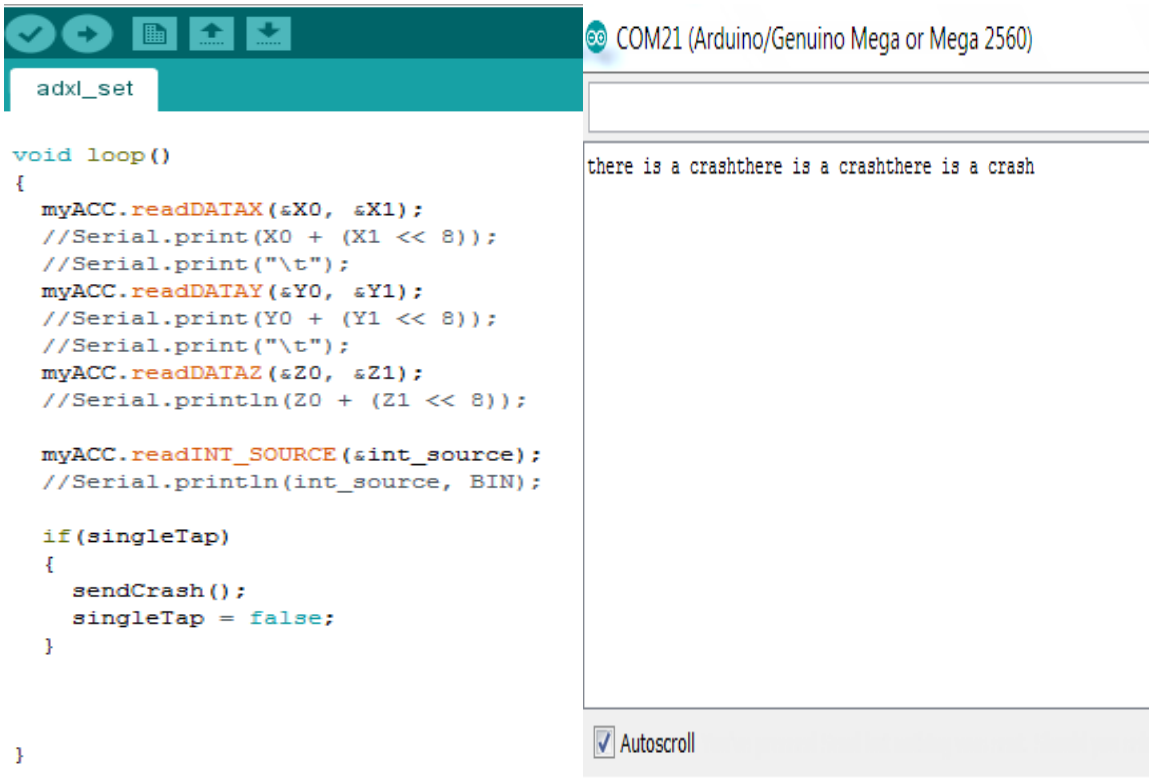


Fig 5.16: ADXL Validation code and results.

5.3 GSM/GPRS+GPR Shield validation

We validated GSM/GPRS+GPR Shieldalone , by combine it to Arduino uno and put a SIM card in the shield then applying the correct code as shown in figure 5.16.

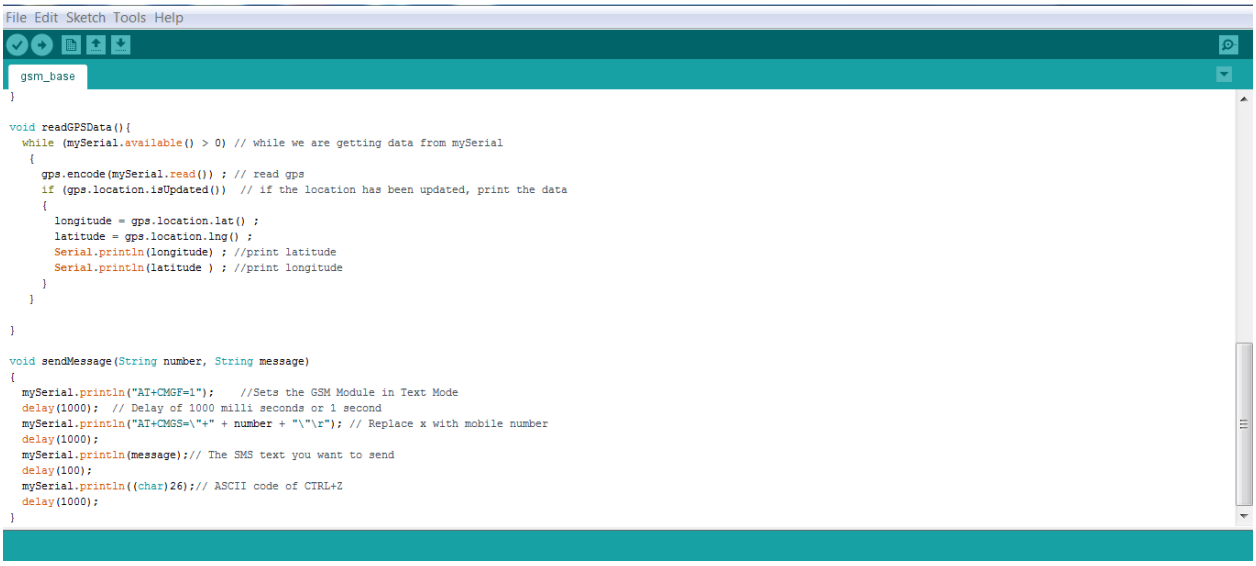


Fig 5.16: SIM808 arduino code

5.4 KSPD system validation

Here we validated GSM/GPRS+GPR Shield and sensors ,connecting with Arduino uno and arduino mega all together as shown in figure 5.17, that shows the entire connections of the hardware with power supply and a dc motor connecting to a stepper motor that passing the order from arduino to dc motor to open the window.

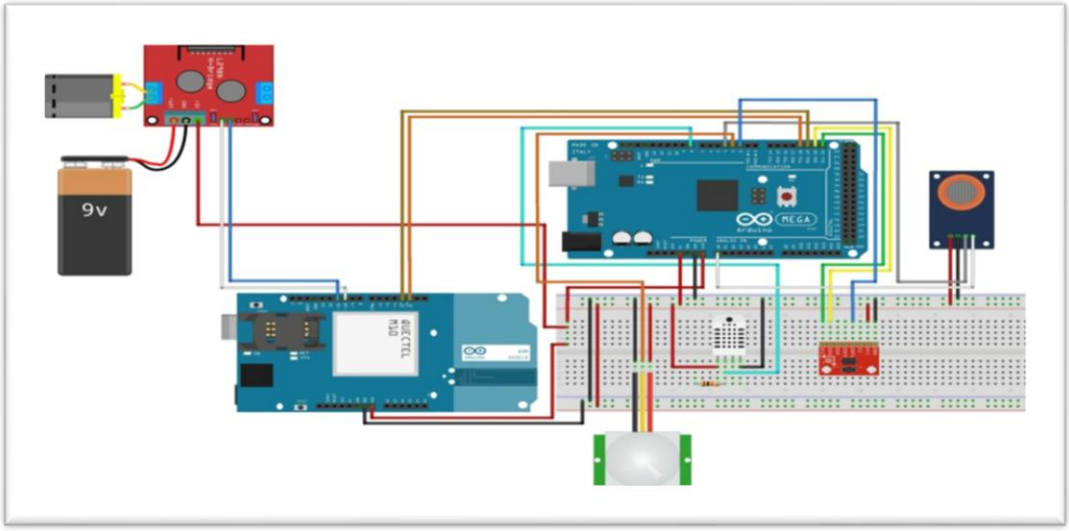


Fig 5.17:KSPD construction

5.5 **Testing**

- The test was carried out in the Kia Sportage 2013, a large quantity of carbon dioxide, and the child's last minute mode, for sensor movement. The message was sent to the saved number within a period of 0.2 seconds .

- The second test was performed to test the function of the second system in the case of high temperature, we operated the air conditioner in the car for an hour, leading to a temperature inside the 35.6 The child was also placed in the third minute, and close the door of the car tightly, Time of 0.2052 seconds.

- The test was done with high temperature but with no movement in the car and the system did not send any message or do any work, so to make sure the system work we printed the temperature.

- It was an important test to check the effectiveness of the device in the case of the person in the car or the child asleep, and when the test more than 3 times I found the child in the case of the high degree of tractor, it does not movements during sleep, after the temperature to 30 Degree, thus the system sent a message to the parents within a time period of 6 seconds.

- To check the system in the event of an accident was working on a car model.

Chapter 6
Validation and Discussion

6.1 Implementation challenges

We faced many challenges while implementing our system. But the one that is worth mentioning is: that there is no single and consistent model of cars and internal installation, they different from one car to another, and from one version to another. So it was difficult to generalize one way to connect the system to the car .

Each car differs in its internal structure, and connected it is parts to the other, even in the same car model. The composition varies from one version to another .For example, The Kia Sportage 2013 is different in the cable connections of the windows of Kia 2011. It is worth mentioning , Wherever the car is an old in terms of manufacturing ,it easy to installation the system to the car, due to the technological development in our present. We implemented the system on a car that fits this development.

To properly install the system, which achieves its objective ,We had to know the inside details of the Kia Sportage 2013,And building the income. How to connect wires ,which controls the opening of the front window located on the driver's side, and also wire line 50. It is a wire which if its signal is high .This means that the car key is in place. The car alarm unit will be activated in the system if the signal is low, it means that will activate the children's rescue unite from choking or high temperature in the car .

We had to get help from Mechanic engineers, to study car schemas, and to know the wiring needed to connect the system .

6.2 Implementation issues

In the implementation , it was difficult to get some pieces, and this led to delay in the completion of the project, and also to change some functions of the system. Commensurate with the available pieces, which will make the system work as required .

When the code was loaded on the Uno processor, the piece did not withstand the pressure on it, because it contains the GSM 808 piece, which increased the charge and therefore had to be in the code and the command to command AT commands, because it is faster and do not need to add many libraries To handle them, and also easier to call, which improves system responsiveness quickly.

It was also one of the issues we faced, the Civil Defense Center. It contains a land phone and therefore does not receive messages, which required us to visit the center, and know the details of how to contact him, we were helped by a number that is always available at the center to deal with.

References

- [1] Google. 2001. Patents. [ONLINE] Available at: https://www.google.com/patents/US6263272[Accessed 15 May 2017]

- [2] Pololu Robotics and Electronics. 2017.Arduino Mega 2560 R3. [ONLINE] Available at:https://www.pololu.com/product/1699[Accessed 15 May 2017]

- [3]Aliexpress. 2017. GPRS/GSM+GPS shield. [ONLINE] Available at: https://www.aliexpress.com/item/1PCS-A7-GSM-GPRS-GPS-3-In-1-Module-Shield-DC-5-9V-Wireless-Module-for / [Accessed 2October 2017]

- [4] Adafruit. 2017.PIR Motion Sensor. [ONLINE] Available at: https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor?view=all [Accessed 15 May 2017]

- [5] Aliexpress. 2017. Carbon dioxide Sensor. [ONLINE] Available at:https://www.aliexpress.com/item/1PCS-X-New-CO2-sensor-module-MG811-module-free-shipping/ [Accessed 15 December 2017]

- [6] Store arduino. 2017. Arduinouno. [ONLINE] Available at:https://store.arduino.cc/usa/arduino-uno-rev3 /[Accessed 15 May 2017]

- [7] Adafruit. 2017.Breadboard. [ONLINE] Available at:https://learn.adafruit.com/lesson-0-getting-started/breadboard[Accessed 15 May 2017]

- [8] AA Portable Power Corp. 2017.Li-ion Battery. [ONLINE] Available at:http://www.batteryspace.com/customizepolymerli-ionbattery37v3000mah111whwithjstconnector.aspx [Accessed 15 May 2017]

- [9] Adafruit. 2017. DHT Temperature and humidity sensor. [ONLINE] Available at:https://www.adafruit.com/product/385 [Accessed 15 October 2017]

- [10]Adafruit. 2017.ADXL sensor. [ONLINE] Available at:https://learn.adafruit.com/adxl345-digital-accelerometer/overview/ [Accessed 15 October 2017]

`

- [11] https://www.kane.co.uk/knowledge-centre/what-are-safe-levels-of-co-and-co2-in-rooms

- [12] https://www.nbcnews.com/storyline/hot-cars-and-kids/death-hot-cars-facts-figures-prevention-n153776

- [13] https://alcor.org/FAQs/faq02.html