Fire alarm,

System of processor.

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***Abstract***— **the following document shows the process and result of the third project of systems with processors which is an alarm that read the smoke in the case of fire and send information. This is the explanation of how was built and how it works. Also, to demostrate our solution to eventual problems and which were the best ways to optimize and to simplify glaringly the proyect. Alike the article shows the result of working between ATXMEGA128B1 Xplained and code C.**

*Index Terms*—Microcontrollers, Algorithm, ATXMEGA128B, Atmel, Fire, Smoke, alarm.

# INTRODUCTION

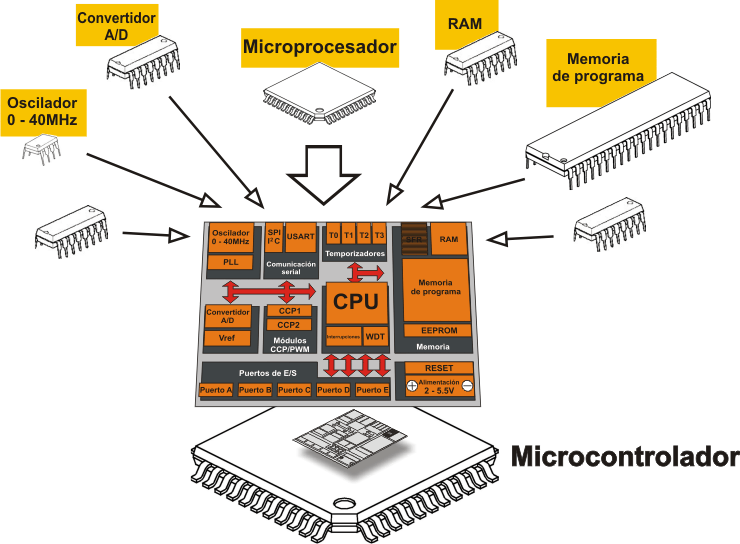
Atmel® microcontrollers (MCUs) deliver a rich blend of efficient integrated designs, proven technology, and groundbreaking innovation that is ideal for today's smart, connected products. In this era of the Internet of Things (IoT), microcontrollers comprise a key technology that fuels machine-to-machine (M2M) communications [1].

[**Atmel AVR 8- and 32-bit Microcontrollers**](http://www.atmel.com/products/microcontrollers/avr/default.aspx) — Atmel AVR® 8- and 32-bit MCUs deliver a unique combination of performance, power efficiency, and design flexibility. Optimized to speed time to market—and easily adapt to new ones—they are based on the industry's most code-efficient architecture for C and assembly programming. The extensive AVR portfolio, combined with the seamlessly-integrated Atmel Studio development platform, makes it easy to reuse knowledge when improving your products and expanding to new markets [1].

A microcontroller is a self-contained system with peripherals, memory and a processor that can be used as an embedded system. Most programmable microcontrollers that are used today are embedded in other consumer products or machinery including phones, peripherals, automobiles and household appliances for computer systems. Due to that, another name for a microcontroller is "embedded controller." Some embedded systems are more sophisticated, while others have minimal requirements for memory and programming length and a low software complexity. Input and output devices include solenoids, LCD displays, relays, switches and sensors for data like humidity, temperature or light level, amongst others [2].

Future Electronics has a wide range of programmable microcontrollers, including pic, low power,LCD, USB and wireless microcontrollers from several manufacturers. Once you decide if you need 8 bit, 16 bit general purpose, 16 bit digital signal controllers or 32 bit microcontrollers, you will be able to choose from their technical attributes and your search results will be narrowed to match your specific microcontroller application needs [2].

We deal with several manufacturers such as Cypress, Microchip, NXP, Renesas Electronics, STMicroelectronics or Zilog. You can easily refine your programmable microcontroller product search results by clicking your preferred microcontroller brand from the list of manufacturers below [2].

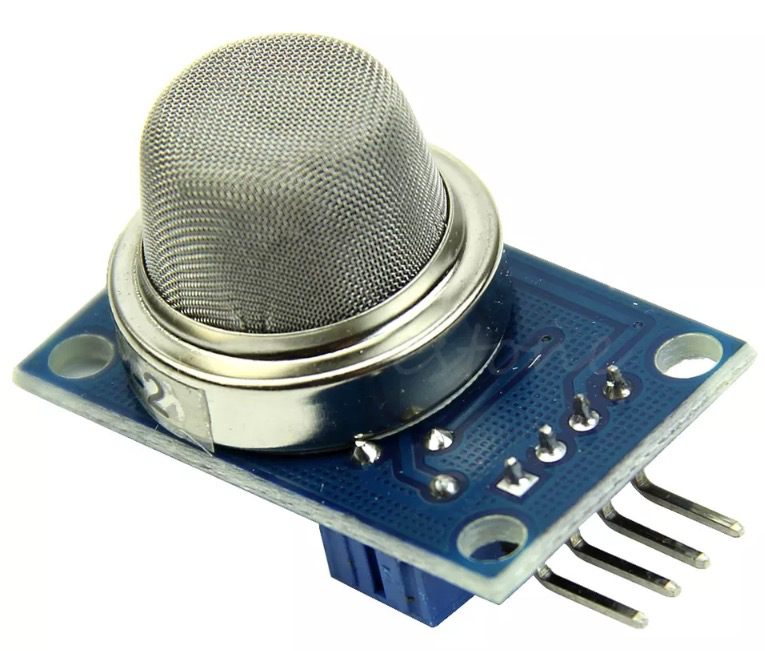


**Fig 1. Describe the parts of the microcontroller.**

Also we discover one sensor to find out how is works the smoke alarm who is MQ2. This sensor is going to send a data for activate a multiple devices in the same time. As well we chose this sensor because it was cheap, easy to use, some website recommends the device [3] and we found it accessible for this project.

The Grove - Gas Sensor(MQ2) module is useful for gas leakage detection (home and industry). It is suitable for detecting H2, LPG, CH4, CO, Alcohol, Smoke or Propane. Due to its high sensitivity and fast response time, measurement can be taken as soon as possible. The sensitivity of the sensor can be adjusted by potentiometer [3].

The MQ series of gas sensors use a small heater inside with an electro-chemical sensor. They are sensitive for a range of gasses and are used indoors at room temperature. The output is an analog signal and can be read with an analog input of the Arduino.Some modules have a built-in variable resistor to adjust the sensitivity of the sensor [4].

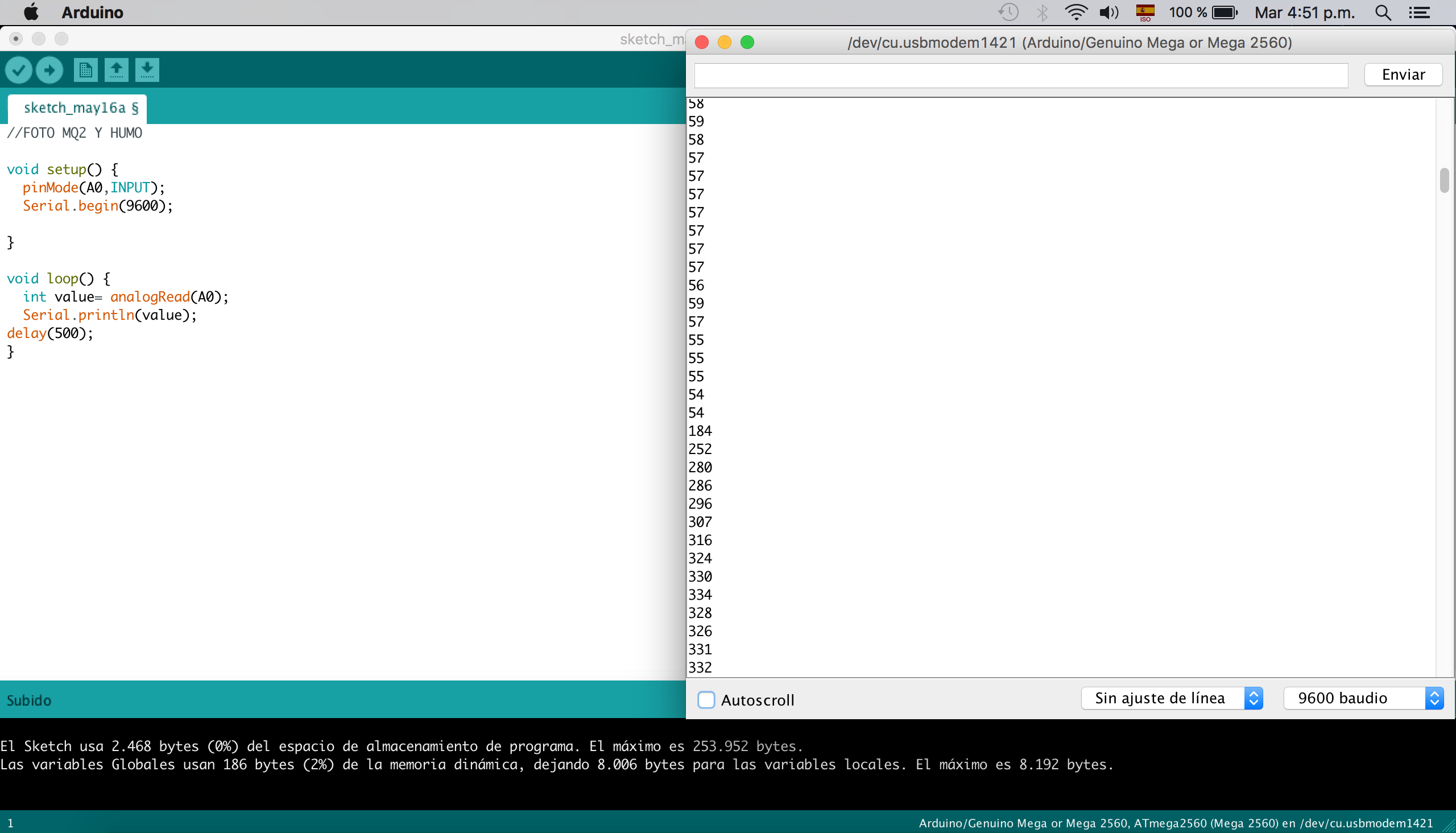


**Fig 2. Gas sensor MQ2.**

There are 4 kinds of gas sensors, every can detect different type of gas, here we use a table to illustrate [3].

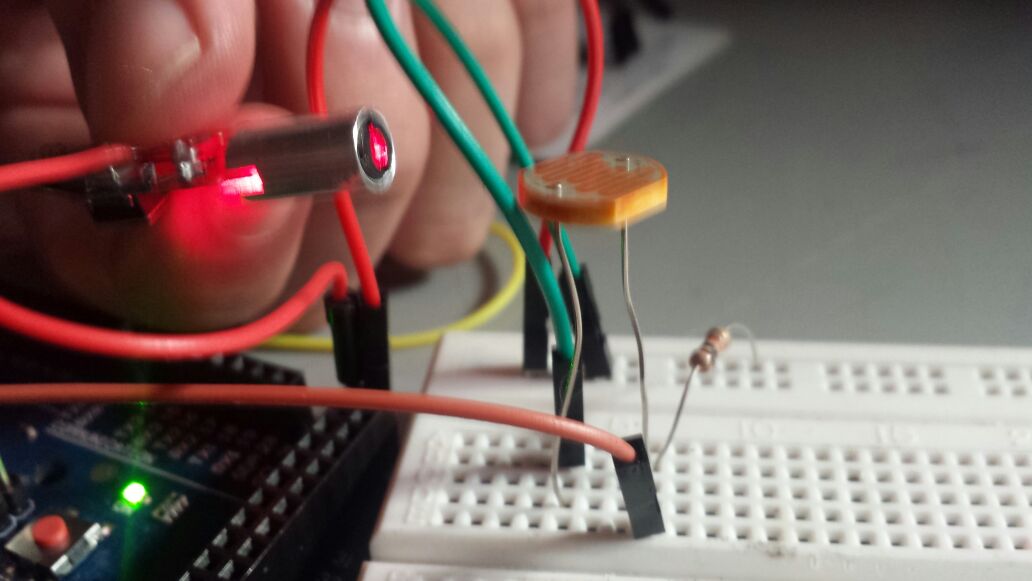
|  |  |
| --- | --- |
| **sensor** | **Gas type** |
| **MQ9** | **Carbon monoxide, coal gas** |
| **MQ2** | **Combustile gas, smoke** |
| **MQ3** | **Alcohol vapor** |
| **MQ5** | **LPG, nature gas, town gas** |

After having it, we started with the arduino tests to see and analyze its effectiveness. After proving it with smoke we could realize that the quality of the data that was transmitting to us was effective to use it in our project. When testing other sensors and with the results of the tests, we could conclude that this sensor was one of the most suitable to carry out the task of adequately fulfilling the exercise of giving data in a fire scene.



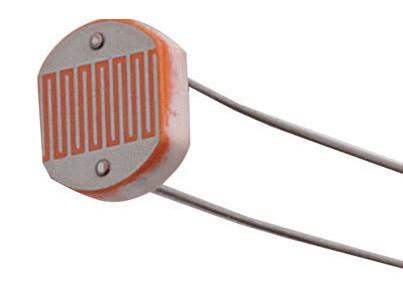
**Fig 9.Test MQ2 in arduino.**

Although, we decided that a sensor was not enough to perform the task to the measure. So we decided to look for another sensor to complete the project. However, we created other sensor, which are a photoresist and a laser. They have to be very close to each other, because when the smoke is seen by the laser, the photoresistance picks up that light signal given by the laser.



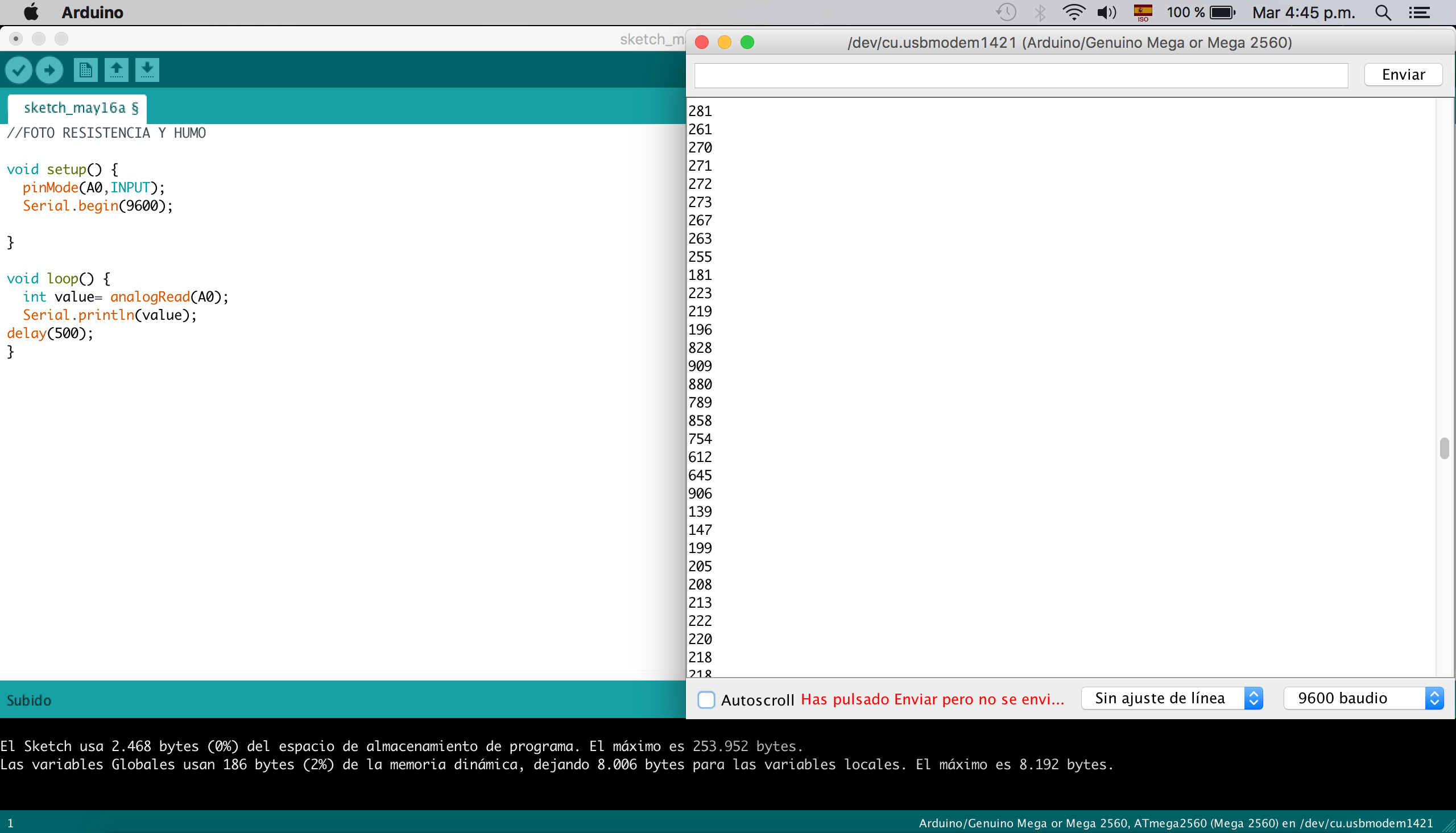
**Fig 10.Test MQ2 in arduino.**

Photocell is a component with resistance varies significantly with the amount of light perceived. The relationship between the light intensity and the resistance value is not linear. It is widely used to measure lighting and electronic devices that require an aggressive price. Its behavior is as follows: More light= less electrical resistance, Less light = greater electrical resistance [9].



**Fig 8.Light Dependent Resistor.**

At the same time we improvise the sensor, we decided to test it on arduino to verify if it was able to help and improve the quality of this project, giving a second data to give general information more accurate.Seeing the results having been tested with smoke, we could see the usefulness that we could add since the precision and the operation was essential. In addition to that the cost was very cheap and also very easy to put together in the circuit.



**Fig 10. Test photoresistance in arduino.**

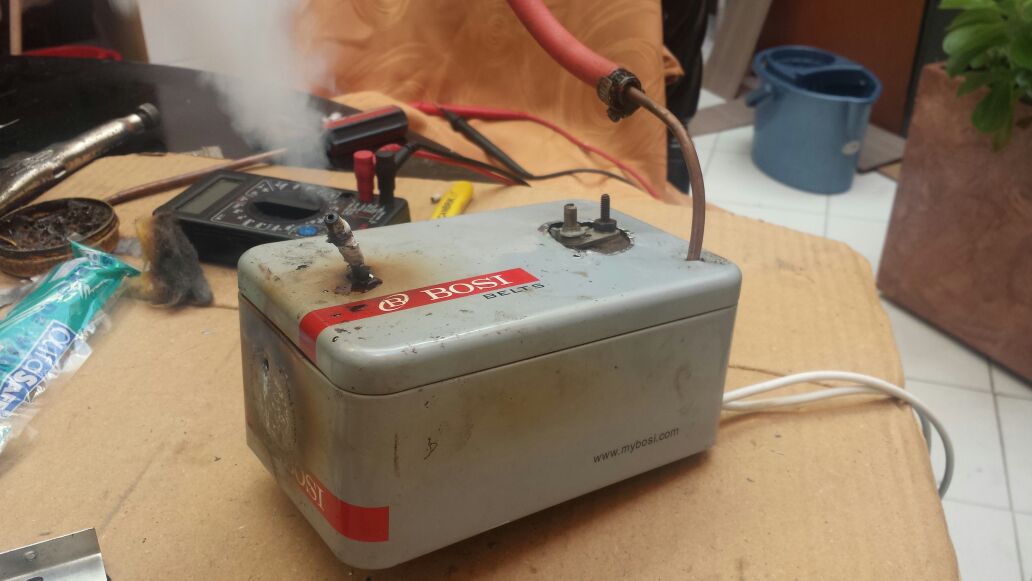
Our proyect is going to use also a Water Pump, because we want to mix and recreate a fire scene so is going to Sprinkle water, when the MQ2 send the information.

The Automatic sprinklers or automatic irrigators are one of the fire-extinguishing systems. Generally they are part of a system against fire based on a reserve of water for the supply of the system and a network of pipes of which terminal elements. They usually trigger the effects of a fire, such as increasing the temperature associated with the fire, or the smoke generated by the combustion [5].



**Fig 3. Water Pump.**

At the same time, we built a smoke chamber with a heat resistance surrounded by a copper tube, through which passes the liquid that evaporates and thus producing smoke or steam.



**Fig 11. Smoke chamber.**

Heating resistors convert electrical energy into heat. At present the heating resistors are used for many applications. The vast majority of them are made with a wire of nickel alloy (80%) and chromium (20%). This alloy supports very high temperatures (1000 ° C), is resistive (condition necessary to generate heat), is very resistant to impacts and is stainless [6].



**Fig 4. Heat resistence.**

These are the most important elements for this project, however to build the circuit we use other basic things for the operation.

* Resistance.
* Leds.
* Rele.
* Transistors.
* Cables.
* Heatresistance
* Diode laser

In fact we created some devices for this project, because we wanted to personalizate all the scene and recreated the best way the case of a fire in a house. Also the experience to achive more knowledge to our way. But we had to see some project that are on internet to have an idea and proceed with security on our project. There are question that we have to take with careful and attention.

* What clock frequency is being used and why?

We are using a frequency of 2MHz which is the default of the processor, as it reaches and gives us the correct time to perform the tasks of the sensors, the second functions of the system as the watering machine and also the time in which it sends the data to give alarm.

The use that we are going to give the microcontroller and the goal of this project is to produce a fire alarm. The alarm must take all the data and according to that prepares the sprinkler and sending the information through the internet. The main function of a digital controller is to keep it activated in a timely and correct manner when detecting changes in the environment.

* What problem is solved?

This project has been made for the understanding of a common problem that is lacking in many structures. What are looking for is solves or reduces the margin of accidents, loss of materials and lives. It also prevents the start of a fire and safeguard the building.

* What are theapplications?

The applications of this project are to adapt the safety procedure for most buildings against imminent danger, fire extinguishing and detection, method to communicate in real time to the respective authorities and update the system. In the case of real life these mechanisms and applications help save lives or prevent accidents.

* What antecedents exist?

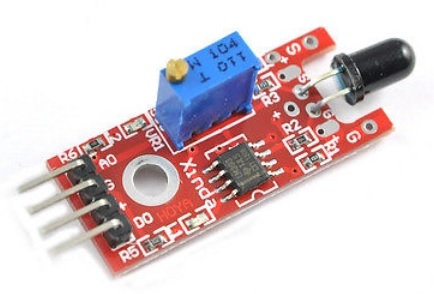
We can find similar projects on the internet that we can compare with our project. Also the differences are the sensor and the microcontroller in which it works since we can see a lot of Operations with fire, smoke, some Chemicals and light. Here some of those projects.

1. The first project on arduino, they used a Flame sensors.

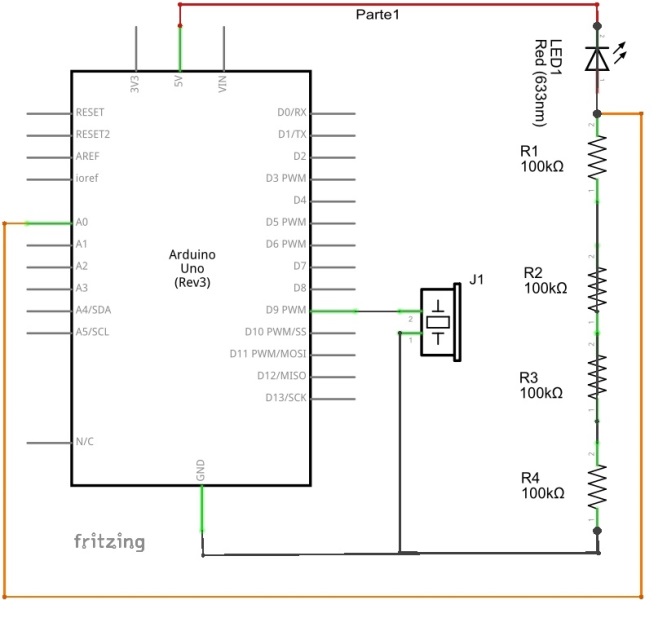
The industry supplies them of all types, sizes and prices, because the idea that you burn the house or the company is something that helps a lot to get the portfolio and look for a detector that is able to warn you in time that there are flames Close to your things. In fact, it is very likely that you have several of these detectors in your house. Imagine, for example, gas heaters, domestic gas ovens, or a simple water heater and heating [7].

All of them require a flame burning gas. If for any reason the flame is extinguished and you do not detect it, the gas would continue to flow and cause a embalming, ready to cause an explosive dislike. Therefore, all these appliances, and their industrial equivalents, incorporate by law, a flame detector, that can cut the gas as soon as it detects lack of flame[7].

In a normal environment, the ignition of a flame causes a powerful ionization of common gases (actually an ionized plasma, similar to that illuminated by a halogen lamp), which generate a typical frequency pattern in the ultraviolet range. The detector is a semiconductor sensitive to this frequency range.   
When the flame stabilizes, it is relatively easy to detect its infrared spectrum, with a LDR photoresist, but designed to be specifically sensitive to a characteristic range. They are going to use a very simple and easy to handle sensor that is an infrared flame sensor. They operate by detecting a specific wavelength (about 760 nm) that are characteristic of the flames, although they are relatively easy to fool and can give false positives with certain lights [7].



**Fig 5. Infrared flame sensor.**



**Fig 6. The electrical scheme.**

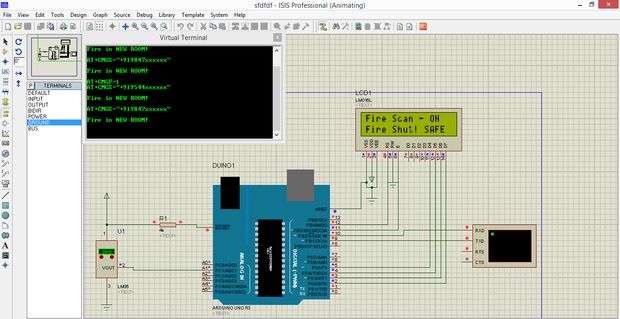
In this project it can be observed that it is very viable to build a fire alarm although the precision and the simplicity are not very exact which can cause us problems in the hour of operation. But if it serves us at the time of sending an information and send it online.

1. One of the ways to detect a fire is by changing the temperature. Another project in arduino is the use of a sensor temperature.

Did you know that 87% of fire damage occurs due to early fire detection but now we are going to try to reduce this percentage with the help of technology so it starts when it causes a fire of the module Gsm will send an SMS to a numbers of Mobile users specified that "fire" and nothing can replace this message with its own string.We set the temperature threshold value in code if (temperature\_value\_val> 45) when the temperature reaches 45c will send sms to a user, the mobile number that the fire produced can replace the temperature value by its own but remember that normal to The ambient temperature is almost equal to 25c before its temperature threshold first make sure what is the temperature of your room and set the threshold value based on room temp. You can replace this mobile phone number of a person's mobile phone number to receive a fire alert sms ("AT + CMGS = \" + 9295440000000 \ "\ r") [8].

Components:

* GSM MODULE
* LCD 16 X 2
* LM35 TEMPERATURE SENSOR
* Arduino 5V Power Supply
* 12V power supply for GSM module
* 10 k PotentioMerter
* Arduino



**Fig 7. The electrical scheme of GSM fire alarm system.**

In this case the most outstanding is the sample of the signal through text messages, this form is very similar to what we seek to do through the internet. In addition to the sensor used in this case on fires could be better and more effective than the last project.

The purpose of the paper on which this document is based is to exercise the knowledge gained in class about programming to create a device with the microprocessor and exercise a program that works with external and internal data in real time.

The problem arises of finding a method in which a resource can be created that supports the established processes for the development of the code and functions, thus giving an optimization of the process, joining the acquired concepts about the development of a software

As base was obtained a code in which a model was observed, where as objective the idea of ​​reducing the time of execution, operation and simplicity was raised. For this it was necessary the implementation of techniques in which transforming the code could be obtained a more effective.

After having made the search of the sensors to implement and to do the respective tests. We do the schematics of the project to already have a global idea of ​​how to do it in code. The following finite state machines are the proposal that we have solved and applied for the operation of the sensors and the code.

![](data:application/pdf;base64,)

**Fig 9. Finite state machine.**

Our solution includes three main states that are: read, activate and send.

-The first state that is to **read** is in charge of seeing which of the two sensors is capturing information.

-The second state is to **activate**, with this we can make the proposed conditions or situations are evaluated and according to this activate the led, the water, the buzzer and choose in which way the program is.

-The last state is to **send**, which is in charge of sending the mode in which it is operating and repeated if it has not yet completed the operation.

Finally, the states of activate and send are the most important and critical, as they are the basis of the whole code and failing or not completing the task assigned would already be directly affecting the other state and thus the operation of the whole code.

After having chosen the sensors and finished the toric part, we began to realiazar the model with the two sensors already set and ready to work. The two sensors interact to be in the same scenario with the same conditions, also activate the same devices in the moment that is due. The only calculations we had to do was to make the tables of the operating parameters of each sensor, as they work with a vector of 256 positions. In the case of MQ2 it had to be done five in five until 1820 and with this all the positions of the vector are occupied. On the other hand, the smoke sensor was made ten in ten to complete the whole vector, with this it is wanted to work in a good way, logical data and the most accurate.

The performance of the sensors is regular since the sensitivity or functionality of the sensors can be easily discarded. The MQ2 is a very fragile sensor that makes the functionality is not fluid, this produces that the project is not giving accurate and chain information causes the devices that are connected to this sensor to fail. To solve this is normally calibrating the sensor, checking the code and observing the environment. The other smoke sensor, works well since its function is very simple, the only thing that can make its performance fail is the smoke we produce from the smoke machine, because if it does not produce an appropriate amount the sensor will not activate.

Most of the time the operation of the project is good, it can be said that it is fluid until the most common problem (the MQ2 sensor) appears and it is corrected. Additional has to be taken into account that the circuit and card cables generate interference in the operation of the whole project which is detrimental, since it is necessary to verify the code and the sensors in search of if the problems come from here.

The useful life of this project is 70 to 90 percent because the operation is good and successful, and if there are problems can be solved in a fast way.

When the tests were carried out, they were first made separately with their gas and their smoke. In this way the tests were successful and we installed them in the model. The second test that were performed were already installed in the model, the differences were the location of where they would receive the gas and smoke. The first few times errors were made because either the smoke was too far from the sensor or there was not enough power to activate it. One of the failures and the sensor MQ2 in our model is that for security we can not add a gas input as it is very dangerous, so you have to enter with a lighter to give gas to the sensor and activate it. However, after several attempts we managed to work together. The last test was to assemble the devices to be activated at the same time as the sensors, these tests were simpler since the sensors were already working, was more work in the code. To the last it was possible to have tota the functionalities to the highest percentage that could be.

This prototype is superior to the previous antecedents, since this contains more devices and more functions to do. The sensors that are used are more accurate or more efficient than the others, the idea is more complex, the code requires more work and the use contains more solutions in a real scenario.

In conclusion the project was carried out from 8 to 10 because in some occasions it is possible to have a margin of error which has to be saluted. However, the margin of error is not so high so it can be improved and left the project at 100%. The prototype can be improved in many ways by adding more of the same sensors to improve the quality of the data or adding different sensors as temperature. Especially this one could improve the way in which water is watered as building a more adequate and precise form, also the smoke chamber can increase its power and add more hoses in strategic places so that the smoke is more dense. It can be observed that this idea has more solutions which makes it better than the antecedents and that other ideas to treat these scenarios. This project can also use to test infrastructures and to take security measures to prevent material and human losses. The second phase of this product is to be able to send the messages via the internet to be able to notify the relevant authorities so that the reaction time is less and thus to solve the problem. In this way the project to another level and that means that it is a very substantial solution for the market.

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