NASA

INTERNATIONAL SPACE APPS CHALLENGE

MANHATTAN PROJECT

INCREASING FIRE MANAGEMENT OPPORTUNITIES

By:

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Challenge

The lack of effective communication regarding fire detection in communities, both with and without internet access, is a significant challenge that jeopardizes the safety and well-being of people and their properties. This issue is exacerbated in communities without internet access due to technological limitations and a lack of modern communication infrastructure.

In communities with internet access, fire detection can be monitored in real-time through advanced sensor systems and online alert systems. However, even in these environments, communication with residents may be insufficient due to limited means of dissemination, such as applications and/or social networks.

In communities without internet access, the lack of modern technology presents even greater challenges. Fire detection may rely primarily on traditional systems like sirens, speakers, or manual patrols. However, these methods may not be efficient enough to alert all residents quickly and accurately, especially in extensive or remote areas, as these detection methods depend on human visualization for activation.

Why was this issue chosen to be addressed?

This issue was chosen to be addressed because fires pose a serious and recurrent threat globally, with devastating consequences for the environment, human life, economy, and public health. These disasters can occur in various environments, including forests, urban areas, and agricultural zones. Although determining the exact number of fires globally can be complex due to variations in how they are recorded and reported in different regions, it is estimated that hundreds of thousands of fires occur each year worldwide.

The risks associated with fires are numerous. Firstly, they represent a serious threat to human life and safety, especially when they spread rapidly and catch people off guard. Additionally, fires can destroy homes, infrastructure, and assets, resulting in significant economic losses.

In terms of environmental impact, forest and vegetation fires damage fragile ecosystems and natural habitats. Extensive loss of flora and fauna occurs, affecting biodiversity and the ecosystems' ability to recover. Furthermore, these fires release large amounts of greenhouse gases, including carbon dioxide and methane, contributing to climate change.

Proposed Solution

The proposed solution to address the dissemination of information in communities with internet access is based on creating a website where anyone can easily inspect the behavior of fires near their community and alert the rest of the population.

In addition to the aforementioned website, a series of social networks will be implemented to provide information about fires, prevention measures, and how to act in their presence. This will include providing fire incidents through Telegram to the user.

On the other hand, to communicate the existence of a fire to communities without internet access, an information network will be implemented using radio frequency signals using LoRa transmitters. Devices will be strategically placed to establish communication between the community without internet access and a community with internet access. This way, when satellite sensors register a fire near the community without internet, the information network will send an alert to the community, allowing them to take preventive measures.

Required Resources

The following resources will be needed for the implementation of this solution:

- Python software
- Design software
- HTML coding
- C languaje in Microchip Studio
- Kicad desing

Solution Presentation

Next, the complete project solution documentation will be presented. This will include the codes developed for each section, from the bots, webpage, information collection, to the

programming of microcontrollers with LoRa modules. Additionally, conceptual renders of the radio frequency transmission apparatus will be provided.

Codes Used:

Page Code:

- HTML Code:

```
<!DOCTYPE html>
<html lang="en">
<head>
        <meta charset="UTF-8">
        <meta name="viewport" content="width=device-width, user-
scalable=no, initial-scale=1.0, maximum-scale=1.0, minimum-scale=1.0">
        <title>Seccion Desplegable</title>
        <link rel="stylesheet" href="css/estilos.css">
        <link rel="stylesheet"
href="https://necolas.github.io/normalize.css/3.0.2/normalize.css">

        <script src="http://code.jquery.com/jquery-
1.11.3.min.js"></script>
</head>
<body>
        <section class="seccionToggle">
                <div class="wrap">
                        <h2 id="pepe">Managing Fire</h2>

                        <button>MANHATTAN PROJECT</button>
                </div>
        </section>

        <a href="#" id="btn-toggle" class="btn-toggle">Abrir</a>

        <div class="contenedor">
                <header>
                        <div class="logo">
                                <img src="images/logo.jpg" width="150"
alt="">
                                <a href="#">Managing Fire</a>
                        </div>

                        <nav>
                                <a
href="https://t.me/SpaceAppsFireAlarm">enroll bot telegram</a>
                                <a
href="https://www.instagram.com/_manhattan.project_/">instagram</a>
```

```
                                <a
href="https://www.facebook.com/profile.php?id=61552138981699&is_tour_dism
issed=true">facebook</a>
                                <a
href="https://firms.modaps.eosdis.nasa.gov/map/#m:tsd;d:today;@-
96.8,22.6,5.1z">real time map</a>
                        </nav>
                </header>

                <section class="main">
                        <article>
                                <h2 class="titulo">Is there any
solution?</h2>
                                <p>In terms of environmental impact, forest
and vegetation fires damage fragile ecosystems and natural habitats.
Extensive loss of flora and fauna occurs, affecting biodiversity and the
ecosystems' ability to recover. Additionally, these fires release large
amounts of greenhouse gases, including carbon dioxide and methane,
contributing to climate change.</p>

<p>Solution Proposal The proposed solution to address information
dissemination in communities with internet access is based on creating a
website where anyone can easily inspect the behavior of fires near their
community. Users will also be able to receive reports from other users
and compare them with data provided by satellite sensors to alert the
rest of the population.</p>

<p>Additionally, alongside the aforementioned website, a series of social
media platforms will be implemented to provide information about ongoing
fires, prevention measures, and how to act in their presence. Users will
also receive fire-related updates via SMS.</p>

<p>On the other hand, to communicate the existence of a fire to
communities without internet access, an information network using
radiofrequency signals will be implemented, utilizing LoRa transmitters.
Devices manufactured with these transmitters will be strategically placed
to establish communication between the community without internet access
and a community with internet access. This way, when satellite sensors
detect a fire near the community without internet, the information
network will send an alert to the community, allowing them to take
preventive measures in response to the event.
</p>
                        </article>

                        <article>
                                <h2 class="titulo">Consult the preventive
measures to avoid wildfires</h2>
                                <ul>
                                <p> Consult the preventive measures to
avoid wildfires in our mountains and hills. This season, there are winds
and drier-than-normal weather conditions that can trigger them.</p>
```

```
                                <li>Do not throw matches or lit cigarettes
on the road, especially not in the middle of the forest.</li>

                                <li>Do not litter bottles or glass can
start a fire by creating a magnifying effect with the sun' srays.</li>
                                <li>Avoid making campfires; no matter how
cautious you are, a flame can cause a major fire.</li>
                                <li>Avoid parking vehicles on the side of
the road where there is dry grass.</li>
                                <li>Leave nothing flammable after
camping.</li>
                                <li>Do not light fires in the woods if
conditions are unfavorable.</li>
                                <li>Store flammable liquids in protected
areas.</li>
                                <li>Do not accumulate garbage on the
premises.</li>
                                <li>Refrain from setting fire to the
grounds.</li>
                                <li>Keep matches out of children's
reach.</li>
                                <li>Extinguish the fire immediately if you
see a campfire or the start of a fire.</li>
                                <li> Encircle it with green branches or
douse it with water or dirt.</li>

                                </ul>

                        </article>

                        <article>
                                <h2 class="titulo">communities without
internet access</h2>
                                <p>The lack of effective communication
regarding fire detection in communities, both with and without internet
access, is a significant challenge that jeopardizes the safety and well-
being of individuals and their properties. This issue is exacerbated in
communities without internet access due to technological limitations and
the lack of modern communication infrastructure.</p>
                                        <p>In communities without internet
access, the lack of modern technology presents even greater challenges.
Fire detection may primarily depend on traditional systems like sirens,
loudspeakers, or manual patrols. However, these methods may not be
efficient enough to alert all residents quickly and accurately,
especially in extensive or remote areas. This is because these detection
methods rely on human visualization for their activation.</p>
                        </article>

                        <article>
                                <h2 class="titulo">communities with
internet access</h2>
                                <p>In communities with internet access,
fire detection can be monitored in real-time through advanced sensor
```

```
systems and online alert mechanisms. However, even in these environments,
communication to residents can be inadequate due to the limited means of
dissemination, such as applications and/or social networks.
                                </p>

                                <p>Why was this issue chosen to be
addressed? This issue was chosen to be addressed because fires represent
a serious and recurring threat globally, with devastating consequences
for the environment, human life, the economy, and public health. These
disasters can occur in various environments, including forests, urban
areas, and agricultural zones. Although determining the exact number of
fires globally can be complex due to variations in reporting and
recording across different regions, it is estimated that hundreds of
thousands of fires occur every year worldwide.</p>


<p>The associated risks of fires are numerous. Firstly, they pose a
serious threat to human life and safety, especially when they spread
rapidly and catch people off guard. Furthermore, fires can destroy homes,
infrastructure, and property, leading to significant economic losses.</p>




                        </article>


                        <article>
                                <h2 class="titulo">our solution</h2>
                                <p>Lorem ipsum dolor sit amet, consectetur
adipisicing elit, sed do eiusmod
                                tempor incididunt ut labore et dolore magna
aliqua. Ut enim ad minim veniam,
                                quis nostrud exercitation ullamco laboris
nisi ut aliquip ex ea commodo
                                consequat. Duis aute irure dolor in
reprehenderit in voluptate velit esse
                                cillum dolore eu fugiat nulla pariatur.
Excepteur sint occaecat cupidatat non
                                proident, sunt in culpa qui officia
deserunt mollit anim id est laborum.</p>
                        </article>




                </section>

                <aside>
    <div class="widget">
        <div class="imagen">
```

```
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\descarga.png" >
        </div>
    </div>



        <div class="widget1">
                <div class="imagen1">

                </div>
            </div>




    <div class="widget">
        <div class="imagen">
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\1.png" alt="Descripción de la otra imagen">
        </div>
    </div>


    <div class="widget">
        <div class="imagen">
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\2.png" >
        </div>
    </div>

    <div class="widget">
        <div class="imagen">
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\3.png" >
        </div>
    </div>

     <div class="widget1">
                <div class="imagen1">

                </div>
            </div>

            <div class="widget">
        <div class="imagen">
```

```
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\descarga.png" >
        </div>
    </div>

    <div class="widget">
        <div class="imagen">
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\descarga.png" >
        </div>
    </div>


     <div class="widget1">
                <div class="imagen1">

                </div>
            </div>


<div class="widget">
        <div class="imagen">
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\descarga.png" >
        </div>
    </div>

<div class="widget">
        <div class="imagen">
            <img src="C:\Users\pepe_\OneDrive\Documentos\nueva
pag\Seccion-Desplegable-con-Jquery-master\Seccion-Desplegable-con-Jquery-
master\img\descarga.png" >
        </div>
    </div>




</aside>


                <footer>
                        <section class="links">
                                <a
href="C:\Users\pepe_\OneDrive\Documentos\nueva pag\Seccion-Desplegable-
con-Jquery-master\Seccion-Desplegable-con-Jquery-master\img\3.2.docx"
download="3.2.docx">Descargar Archivo esquematico</a>
                                <a href="ruta_del_archivo.zip"
download="nombre_del_archivo.zip">Descargar Archivo diseño cad</a>
```

```
                                <a href="ruta_del_archivo.zip"
download="nombre_del_archivo.zip">Descargar Archivo pcb</a>
                                <a
href="https://t.me/SpaceAppsFireAlarm">GitHub</a>
                        </section>


                </footer>
        </div>
        <script src="js/seccion.js"></script>
```

- Java code

```
if (estado == true) {
            $(this).text(" Cerrar");
            $('body').css({
                "overflow": "auto"
            });
            estado = false;
        } else {
            $(this).text("Abrir");
            $('body').css({
                "overflow": "hidden"
            });
            estado = true;
        }
    });
});
```

- Style code

```
* {
  -webkit-box-sizing: border-box;
  -moz-box-sizing: border-box;
  box-sizing: border-box; }

body {
  background: #111111;
  color: black; /* cambia el color de la letra del texto principal */
  font-family: "Helvetica, Arial, Sans-serif"; }

a {
  color: white;
  text-decoration: none; }
  a:hover {
    text-decoration: underline; }

#pepe{
```

```
  color: black;
  box-shadow: 1px 10px 10px black;
  background: rgba(255, 255, 255, 0.6);
  border: 5px solid #001F3F;
}

.wrap {

  color: #ffff;
  font-family: "pacifico";
  width: 90%;
  max-width: 1000px;
  margin: auto; }

.main {
  width: 100%;
  min-height: 1500px; }

.seccionToggle {
  display: none;
  height: calc(100vh - 50px);
  background-image: url('C:/Users/pepe_/OneDrive/Documentos/nueva
pag/Seccion-Desplegable-con-Jquery-master/Seccion-Desplegable-con-Jquery-
master/img/portrait.png');
  background-repeat: no-repeat;
  background-size: cover;
  color: #fff;
  padding: 50px 0;
  text-align: center; }
  .seccionToggle h2 {
    font-size: 60px;
    margin-top: 50px; }
  .seccionToggle p {
    font-size: 20px;
    margin-bottom: 50px; }
  .seccionToggle button {
    color: black;
     box-shadow: 1px 10px 10px black;
   background: rgba(255, 255, 255, 0.6);
    font-size: 20px;
    font-weight: bold;
    padding: 20px 40px;
    display: inline-block;
    border: 5px solid #001F3F;
    transition: 0.3s all ease; }
    .seccionToggle button:hover {
      border: 5px solid #0074D9;
      color: #0074D9; }

.btn-toggle {
  height: 50px;
  line-height: 50px;
  font-size: 24px;
```

```
  font-weight: bold;
  color: #000;
  display: block;
  background: #F6B106 ;/* cambia el color de la letra del texto principal
*/
  text-align: center; }
  .btn-toggle:hover {
    text-decoration: none; }

@media screen and (max-width: 500px) {
  .seccionToggle h2 {
    margin-top: 0; } }
@media screen and (max-height: 550px) {
  .seccionToggle h2 {
    font-size: 40px;
    margin-top: 0; } }

/*#
.....................................................................
...... */

.contenedor {
  background:#black;
  width:100%;
  max-width:1000px;
  margin:auto;

  /* Flexbox */
  display:flex;
  flex-flow:row wrap;
}

body {
   background-image: url('C:/Users/pepe_/OneDrive/Documentos/nueva
pag/Seccion-Desplegable-con-Jquery-master/Seccion-Desplegable-con-Jquery-
master/img/firebanner.jpg');
}

header {
  border: 5px solid #000; /* Establece un borde sólido de 2 píxeles de
ancho y color negro */

  background:#D23506;/* colo header */
  width:100%;
  padding:20px;

  /* Flexbox */
  display: flex;
  justify-content:space-between;
  align-items:center;

  flex-direction:row;
  flex-wrap:wrap;
```

```
}

header .logo {
  color:#000;
  font-size:30px;
}

header .logo img {
  width:50px;
  vertical-align: top;
}

header .logo a {
  color:#fff;
  text-decoration: none;
  line-height:50px;
}

header nav {
  width:50%;
  /* Flexbox */

  display:flex;
  flex-wrap:wrap;
  align-items:center;
}

header nav a {
  background:#d35400;
  color:#000;
  text-align: center;
  text-decoration: none;
  padding:10px;

  /* Flexbox */
  flex-grow:1;
}

header nav a:hover {
  background:#e74c3c;
}

.main {

  text-align: justify;
   border: 5px solid #000;
  background:#B3B0B0; /* cambiar el color donde ira el texto */
  padding:20px;

  flex:1 1 70%;
  /*flex:1;*/
}
```

```
.main article {
  margin-bottom: 20px;
  padding-bottom:20px;
  border-bottom:2px solid #ffff;
}

.main article:nth-last-child(1){
  margin-bottom: 0;
  padding-bottom: 0;
  border-bottom:none;
}

aside {

  border: 5px solid #000;
  background: #e67e22;
  padding: 20px;
  /* FLEX */
  flex: 1 1 30%;
  /* flex: 0 0 300px; */

  display: flex;
  flex-wrap: wrap;
  flex-direction: column;
  justify-content: flex-start;
}

aside .widget {

  background: #e67e22;
  height: 150px;
  margin: 10px;
  position: relative; /* Agregamos posición relativa para contener las
imágenes */
}

aside .widget1 {

  background: #e67e22;
  height: 70px;
  margin: 10px;
  position: relative; /* Agregamos posición relativa para contener las
imágenes */
}


aside .widget .imagen {
  width: 100%; /* Ancho del widget */
  height: 100%; /* Altura del widget */
  border: 4px solid #000; /* Añadir borde a la imagen */
  box-sizing: border-box;
}
```

```
aside .widget .imagen img {
  height: auto;
  width: 100%;
  height: 100%;
  object-fit: cover;
}



footer {
  background:#2c3e50;
  width: 100%;
  padding:20px;

  /* Flexbox */
  display: flex;
  flex-wrap:wrap;
  justify-content:space-between;
}

footer .links {
  background:#c0392b;
  display:flex;
  flex-wrap:wrap;
}

footer .links a {
  flex-grow:1;

  color:#ffff;
  padding:10px;
  text-align: center;
  text-decoration:none;
}

footer .links a:hover {
  background:#E74C3C;
}




@media screen and (max-width: 800px) {
  .contenedor {
    flex-direction:column;
  }

  header {
    flex-direction:column;
    padding:0;
  }

  header .logo {
```

```
    margin:20px 0;
  }

  header nav {
    width: 100%;
  }

  aside {
    flex-direction:row;
    flex:0;
  }

  aside .widget {
    flex-grow:1;
  }
}

@media screen and (max-width: 600px) {
  aside {
    flex-direction:column;
  }

  footer {
    justify-content:space-around;
  }
}
```

Registration and transmission of data by telegram chatbot:

```
import pandas as pd
import telebot
from datetime import datetime, timedelta
import time
import schedule
from geopy.geocoders import Nominatim

def main():

  fecha_actual = datetime.now()

  fecha_menos_un_dia = fecha_actual - timedelta(days=1)

  FECHA = fecha_menos_un_dia.strftime("%Y-%m-%d")

  print(FECHA)

  def encontrar_ciudad_cercana(latitud, longitud):
    geolocator = Nominatim(user_agent="mi_app")
    ubicacion = geolocator.reverse((latitud, longitud))
```

```
    return ubicacion.address

  MAP_KEY = '724791d412a82892de4d71d974d5e727'

  CHAT_ID="@SpaceAppsFireAlarm" #ID del chat

  TOKEN = "6572209256:AAHG_HN9EbMMstm78xZysh0QzBwJzQfBGQ8" #token de la
API de telegram

  bot = telebot.TeleBot(TOKEN)

  def enviarMensaje(mensaje):
      bot.send_message(CHAT_ID, mensaje)

  #We get the data from the
  mex_url = 'https://firms.modaps.eosdis.nasa.gov/api/country/csv/' +
MAP_KEY + '/VIIRS_SNPP_NRT/MEX/1/' + FECHA
  mex_data = pd.read_csv(mex_url)
  #print(mex_data)
  print('Number of Possible fires: ', len(mex_data))

##########################################################################
#########################################
  #Esta parte del codigo seria para limitar la busqueda de Mexio
unicamente a Xalapa
  #Como no hay nada no lo vamos a usar por ahora
  #This part of the code is to limit MexicoOnly to a zone near Xalapa
  #Becuasetheres nothing,we are not going to use it for demonstration
porpuses
  #extent = [19.30,-97.332 ,19.832,-96.502]
  #df_xalapa = mex_data[(mex_data['longitude'] >= extent[0]) &
(mex_data['latitude'] >= extent[1]) & (mex_data['longitude'] <=
extent[2]) & (mex_data['latitude'] <= extent[3])].copy()
  #print(df_xalapa)

##########################################################################
#########################################

  #Filtred data
  filtred_mex_data = mex_data[(mex_data['confidence'] == 'n') |
(mex_data['confidence'] == 'h')]
  filtred_mex_data = filtred_mex_data[filtred_mex_data['frp'] > 5]
  #This would be the fires
  #print('Mexico subset contains', len(filtred_mex_data), 'fires.')

  #here I print and get the latitudes and longitudes
  coordenadas = [(row['latitude'], row['longitude']) for index, row in
filtred_mex_data.iterrows()]

  #here I print my latitudes and longitudes to check
  puntero = 0
  while puntero < len(coordenadas):
      latitud, longitud = coordenadas[puntero]
```

```
        #print(f'Latitud: {latitud}, Longitud: {longitud}')
        puntero += 1

    #How many fires I have in the zone
    #print(f"Longitud del vector: {len(coordenadas)}")
    print(f"How many real fires are there: {puntero}")

    filtred_mex_data['acq_time'] =
filtred_mex_data['acq_time'].astype(str).str.zfill(4)
    # Extrae las horas y minutos y crea una columna acq_datetime solo con
la hora en formato 'H:M'
    filtred_mex_data['acq_datetime'] =
pd.to_datetime(filtred_mex_data['acq_time'],
format='%H%M').dt.strftime('%H:%M')
    # Extrae las horas en el formato 'H:M' y guárdalas en un vector
    horas = filtred_mex_data['acq_datetime']
    #print(horas.tolist())

    puntero = 0
    while puntero < len(coordenadas):
        latitud, longitud = coordenadas[puntero]
        ciudad= encontrar_ciudad_cercana(latitud, longitud)
        horas_actual=horas.iloc[puntero]
        mensaje = f'*¡¡ALERTA DE INCENDIO!!* Se ha detectado un posible
incendio cerca de la siguiente localidad/ciudad: {ciudad}. La hora del
sinsiestro registrado es {horas_actual}'
        enviarMensaje(mensaje)
        puntero += 1

if __name__ == "__main__":

    main()

    schedule.every(30).minutes.do(main)

    # Ejecuta el programa de forma indefinida
    while True:
      schedule.run_pending()
      time.sleep(1)
```

C Microchip Studio LoRa RYLR998:

Code 1

```
#define F_CPU 16000000
#define BAUD 9600
#define BRC ((F_CPU/16/BAUD)-1)
#include <avr/interrupt.h>
#include <util/delay.h>
#include <avr/io.h>
```

```
void anexaSerial(int dato);
void saltoLinea();
void escribeSerial(char *str);
void escribeSerialNum(int num);
void cadena(char *cad);


char ReciveData;


int main(void)
{
	DDRD|=(1<<PIND2)|(1<<PIND3); //Salidaas Actuadores / Leds
	DDRB&=~(1<<PINB0)|(1<<PINB1); //Entradas Botones
	cli();

	//USART
	UBRR0H = (BRC>>8);
	UBRR0L = BRC;
	UCSR0B |= ((1<<TXEN0)|(1<<RXEN0)|(1<<RXCIE0));
	UCSR0C |=  ((1<<UCSZ00)|(1<<UCSZ01));
	sei();

	_delay_ms(1500);
	escribeSerial("AT+BAND=928000000");
	saltoLinea();
	_delay_ms(500);
	escribeSerial("AT+ADDRESS=1");
	saltoLinea();
	_delay_ms(500);
	escribeSerial("AT+NETWORKID=10");
	saltoLinea();
	_delay_ms(1500);



	while (1)
	{

		if ((PINB&(1<<PINB0))==1){

			escribeSerial("AT+SEND=2,1,1");
			//escribeSerial("1");//Para la simulación
			saltoLinea();
			_delay_ms(500);
		}
	if ((PINB&(1<<PINB1))==2){

		PORTD&=(1<<PIND2);
		saltoLinea();
		_delay_ms(500);
	}

	}
}
```

```
anexaSerial(int dato){
	UDR0=dato;
	_delay_ms(30);
}

saltoLinea(){
	anexaSerial(10);
	anexaSerial(13);
}

escribeSerial(char *str){
	while(*str) anexaSerial(*str++);
	saltoLinea();
}

ISR(USART_RX_vect)
{
	ReciveData=UDR0;
	if (ReciveData=='2'){
		PORTD|=(1<<PIND2);
		saltoLinea();
		_delay_ms(500);
	}


}
```

Code 2

```
#define F_CPU 16000000
#define BAUD 9600
#define BRC ((F_CPU/16/BAUD)-1)
#include <avr/interrupt.h>
#include <util/delay.h>
#include <avr/io.h>


void anexaSerial(int dato);
void saltoLinea();
void escribeSerial(char *str);
void escribeSerialNum(int num);
void cadena(char *cad);

//char lora_band= '928000000';
//char lora_NETWORKID= '10';
//char lora_adress= '1';
//char lora_Rx_adress= '2';

char ReciveData;


int main(void)
{
	DDRD|=(1<<PIND2)|(1<<PIND3); //Salidaas Actuadores / Leds
	DDRB&=~(1<<PINB0)|(1<<PINB1)|(1<<PINB2); //Entradas Botones
	cli();
```

```
	//USART
	UBRR0H = (BRC>>8);
	UBRR0L = BRC;
	UCSR0B |= ((1<<TXEN0)|(1<<RXEN0)|(1<<RXCIE0));
	UCSR0C |=  ((1<<UCSZ00)|(1<<UCSZ01));
	sei();

	_delay_ms(1500);
	escribeSerial("AT+BAND=928000000");
	saltoLinea();
	_delay_ms(500);
	escribeSerial("AT+ADDRESS=2");
	saltoLinea();
	_delay_ms(500);
	escribeSerial("AT+NETWORKID=10");
	saltoLinea();
	_delay_ms(1500);



	while (1)
	{



	}
}

anexaSerial(int dato){
	UDR0=dato;
	_delay_ms(30);
}

saltoLinea(){
	anexaSerial(10);
	anexaSerial(13);
}

escribeSerial(char *str){
	while(*str) anexaSerial(*str++);
	saltoLinea();
}

ISR(USART_RX_vect)
{
	ReciveData=UDR0;
	if (ReciveData=='1'){
		escribeSerial("AT+SEND=3,1,1");
		//escribeSerial("1"); //Para la simulación
		saltoLinea();
		_delay_ms(500);
	}
	if (ReciveData=='2'){
		escribeSerial("AT+SEND=1,1,2");
		//escribeSerial("2"); //Para la simulación
		saltoLinea();
```

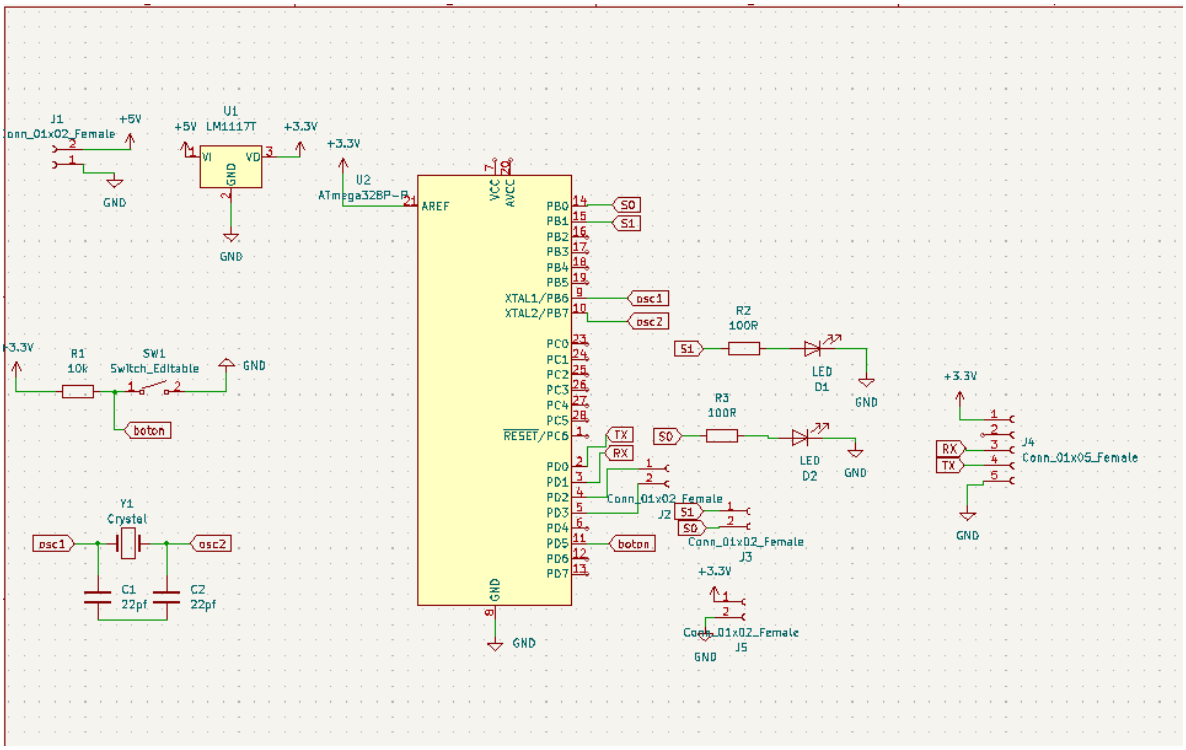
```
            _delay_ms(500);
        }

}
```

Code 3

```
#define F_CPU 16000000
#define BAUD 9600
#define BRC ((F_CPU/16/BAUD)-1)
#include <avr/interrupt.h>
#include <util/delay.h>
#include <avr/io.h>


void anexaSerial(int dato);
void saltoLinea();
void escribeSerial(char *str);
void escribeSerialNum(int num);
void cadena(char *cad);

//char lora_band= '928000000';
//char lora_NETWORKID= '10';
//char lora_adress= '1';
//char lora_Rx_adress= '2';

char ReciveData;


int main(void)
{
        DDRD|=(1<<PIND2)|(1<<PIND3); //Salidaas Actuadores / Leds
        DDRB&=~(1<<PINB0)|(1<<PINB1)|(1<<PINB2); //Entradas Botones
        cli();

        //USART
        UBRR0H = (BRC>>8);
        UBRR0L = BRC;
        UCSR0B |= ((1<<TXEN0)|(1<<RXEN0)|(1<<RXCIE0));
        UCSR0C |=  ((1<<UCSZ00)|(1<<UCSZ01));
        sei();

        _delay_ms(1500);
        escribeSerial("AT+BAND=928000000");
        saltoLinea();
        _delay_ms(500);
        escribeSerial("AT+ADDRESS=3");
        saltoLinea();
        _delay_ms(500);
        escribeSerial("AT+NETWORKID=10");
        saltoLinea();
        _delay_ms(1500);



        while (1)
        {
```

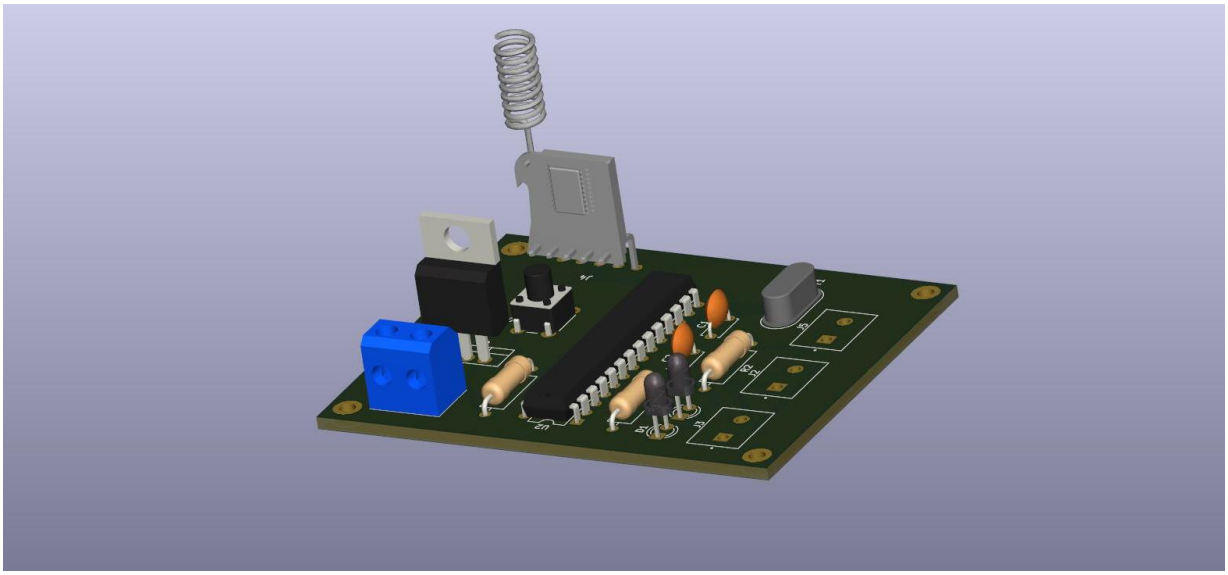
```
                        if ((PINB&(1<<PINB1))==2){
                                PORTD&=~(1<<PIND2);
                                _delay_ms(500);
                        }
                        if ((PINB&(1<<PINB0))==1){
                                escribeSerial("AT+SEND=2,1,2");
                                //escribeSerial("2");//Para la simulación
                                saltoLinea();
                                _delay_ms(500);
                        }

        }



}

anexaSerial(int dato){
        UDR0=dato;
        _delay_ms(30);
}

saltoLinea(){
        anexaSerial(10);
        anexaSerial(13);
}

escribeSerial(char *str){
        while(*str) anexaSerial(*str++);
        saltoLinea();
}

ISR(USART_RX_vect)
{
        ReciveData=UDR0;
        if (ReciveData=='1'){
                PORTD|=(1<<PIND2);
                saltoLinea();
                _delay_ms(500);
        }


}
```

Schematic

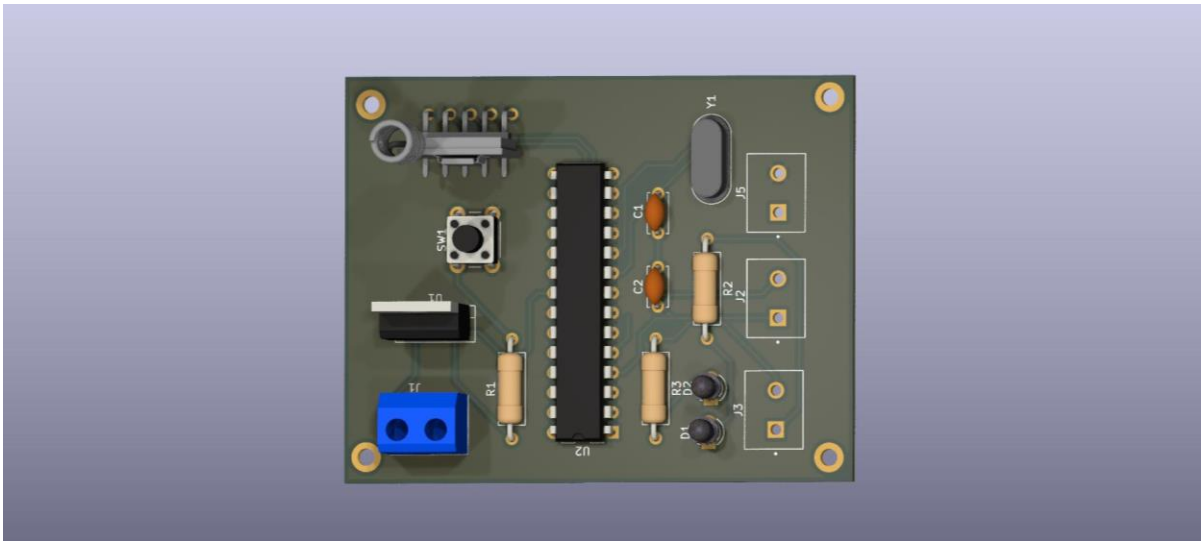


Picture 1. Schematic of the circuit

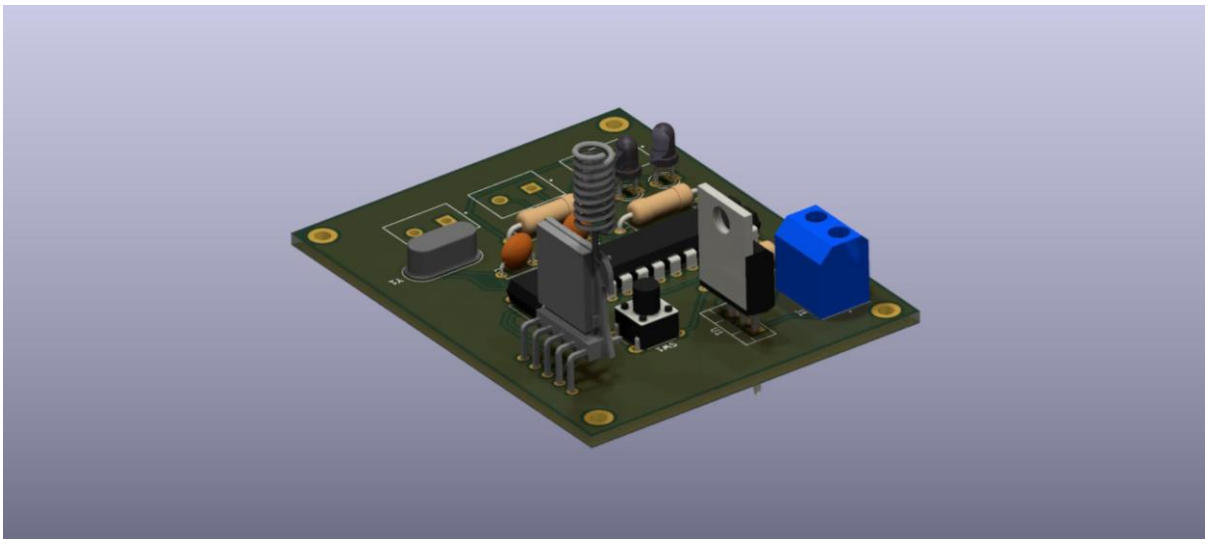
Conceptual Renders



Picture 2. PCB render

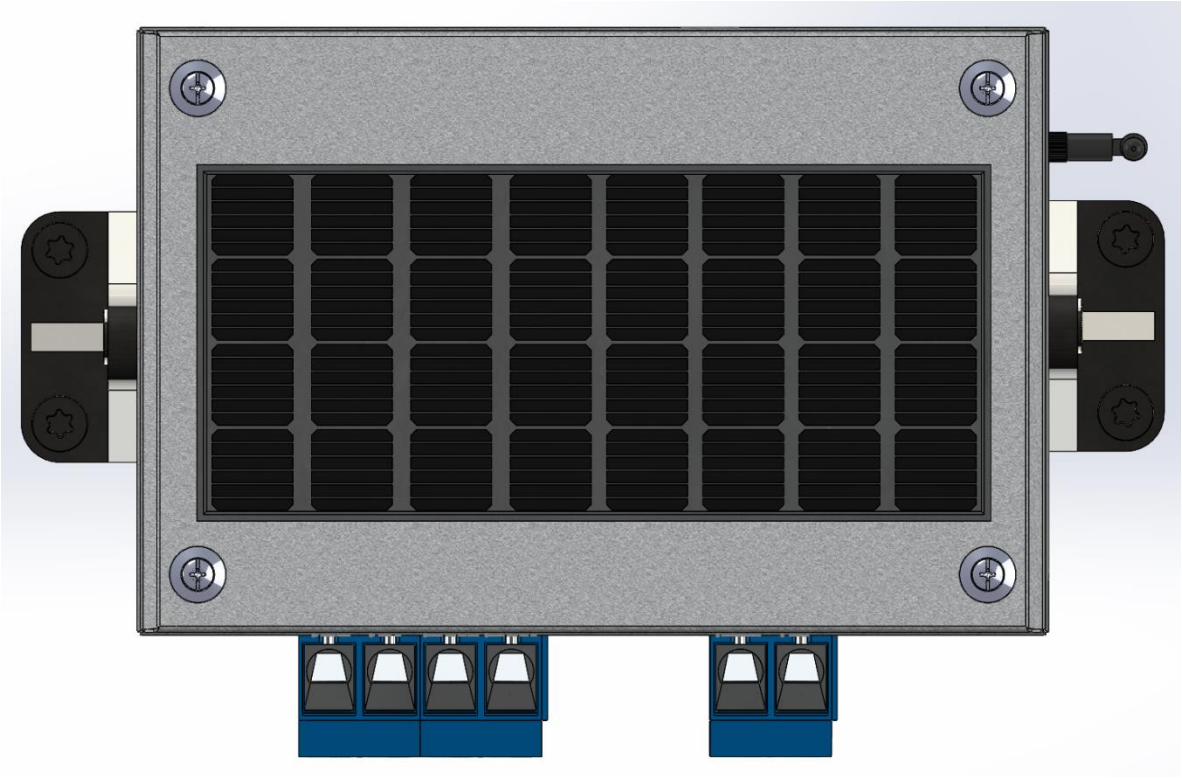


Picture 3. PCB render

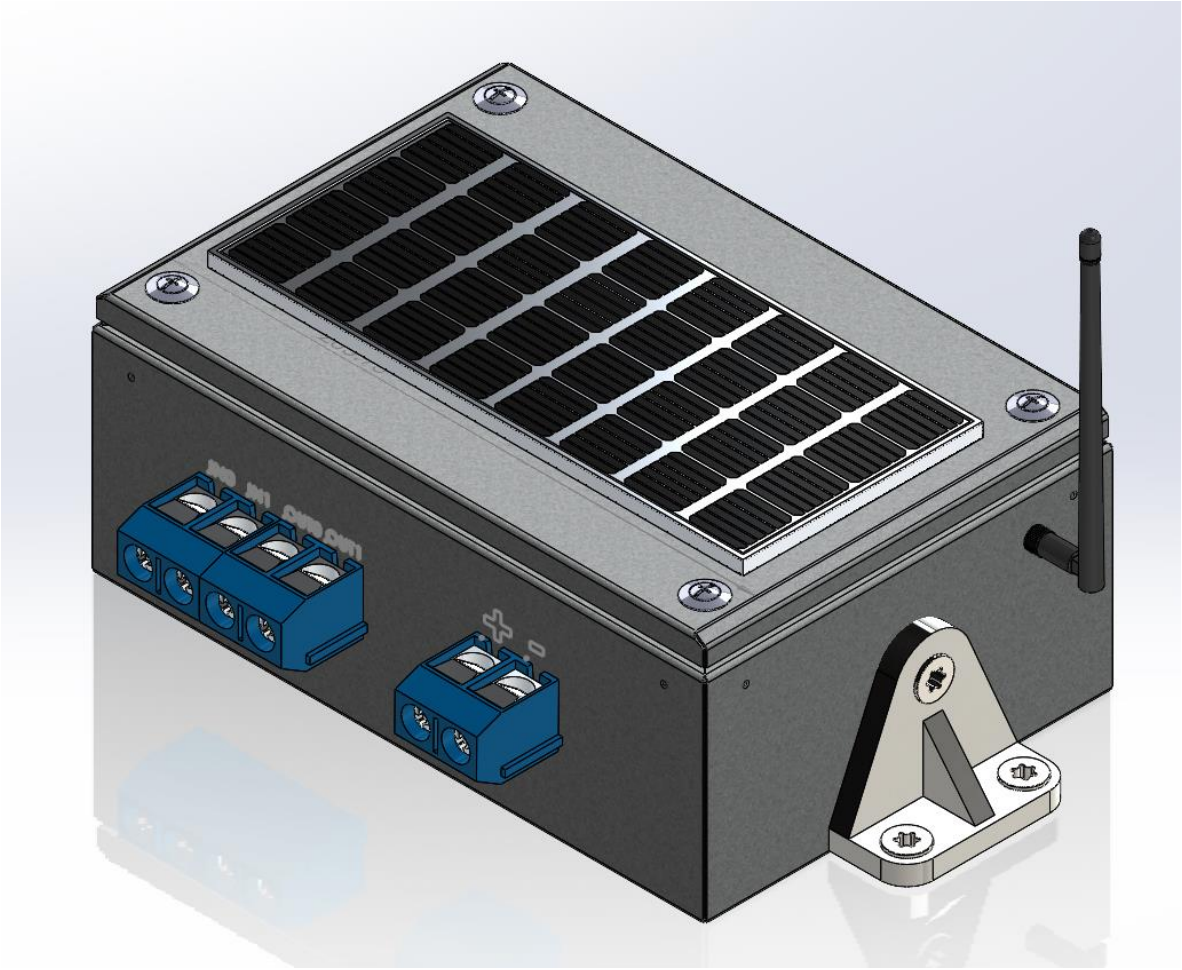


Picture 4. PCB render

Picture 5. Case render



Picture 6. Case render



Picture 7. Case render

Budget

Producto/Service	Cost
Chassis	*$ 20/per prototipe*
PCB	*$25 /per prototipe*
Option 1 Telegram ChatBot hosting: Amazon AWS	*$ 7/ per Month*
Option 2 Telegram ChatBot hosting: The Google Cloud Host	*$34/ per Year*
Host a website: GoDaddy	*$ 5/per Month*

Potential issues with our solution

One of the disadvantages of this prototype is the transmission of data to mountainous areas, due to the technology occupied by the RYLR998 module.

The disadvantage of the telegram chatbot is the repetition of alert messages.

Challenges that we experienced when we were working on the problema

When starting with the processing of the database, difficulties were presented when installing the required libraries

In question on the website, there was a bit of difficulty trying to buy the domain that NASA provided.

In terms of hardware, there were no simulators that had the LoRa component to corroborate the operation in practice of the code.

What have we learned?

As a team we learned to work better as a team, having a better organization and dividing the team, thus streamlining the process of project development.

They learned how to occupy the LoRa modules and transmit great distances.

It was learned how to add download of executables and occupy the web page in a public domain and that other people can occupy it.

Ideas for future improvements

- Make the prototipe in Physical.
- Occupy another LoRa module with greater range and reduce the number of prototypes used for the formation of the network.
- Send alerts through other messaging apps
- Expand within the web page the options so that people can select the region in which they reside.

Information of the Project

Social Networks

Twitter: @ManhattanPSpace

Facebook: Manhattan Project

Intagram: @_manhattan.project_

Telegram Chatbot: t.me/theFireManhattanBot

Website

https://manhattan.courses/

Download documents and archives

https://github.com/Fernando1San/Manhattan-Project-for-NASA-Space-Apps

Resources used

NASA-FIRMS. (2023). Nasa.gov; NASA-FIRMS. https://firms.modaps.eosdis.nasa.gov/space-apps-2023

Qué hacer ante un incendio forestal: lo que tenés que saber. (2023, February 9). National Geographic. https://www.nationalgeographicla.com/medio-ambiente/2023/02/que-hacer-ante-un-incendio-forestal-lo-que-tenes-que-saber

Deadly wildfires, noise pollution, and disruptive timing of life cycles: UN report identifies looming environmental threats. UN Environment (2022). https://www.unep.org/news-and-stories/press-release/deadly-wildfires-noise-pollution-and-disruptive-timing-life-cycles

LANCE: NASA Near Real-Time Data and Imagery | Earthdata. (2021, August 18). Earthdata. https://www.earthdata.nasa.gov/learn/find-data/near-real-tim

NASA-FIRMS. (2023). Nasa.gov; NASA-FIRMS. https://firms.modaps.eosdis.nasa.gov/academy/

NASA-FIRMS. (2023). Nasa.gov; NASA-FIRMS. https://firms.modaps.eosdis.nasa.gov/web-services/gibs/

NASA-FIRMS. (2023). Nasa.gov; NASA-FIRMS. https://firms.modaps.eosdis.nasa.gov/satellite-imagery/