[1. Situation dans le projet 2](#_Toc514227405)

[1.1) Synoptique de la réalisation 2](#_Toc514227406)

[1.2) Rappel des tâches de l’étudiant 3](#_Toc514227407)

[1.3) Contraintes de réalisation 4](#_Toc514227408)

[1.4) Problème matériel 4](#_Toc514227409)

[2. Conception et mise en œuvre 5](#_Toc514227410)

[2.1) Fonctionnement du solarimètre 5](#_Toc514227411)

[2.2) Fonctionnement de la boucle 4-20 mA. 5](#_Toc514227412)

[2.3) Réalisation du diagramme de classe 6](#_Toc514227413)

[3. Etude et configuration réseau 7](#_Toc514227414)

[3.1) Arduino à la Raspberry 7](#_Toc514227415)

[3.2) Applications à la base de données 8](#_Toc514227416)

[4. Récupération et envoie des données 8](#_Toc514227417)

[4.1) Choix du Shield Arduino pour la boucle de courant 8](#_Toc514227418)

[4.2) Mise en place de la boucle 4-20 mA 8](#_Toc514227419)

[4.3) Test du solarimètre 8](#_Toc514227420)

[4.4) Détection du problème 8](#_Toc514227421)

[4.5) Bibliothèque Arduino pour la boucle 4-20 mA 8](#_Toc514227422)

[4.6) Récupérer les données d’un capteur sur la boucle 4-20 mA 8](#_Toc514227423)

[5. Mise en place de l’application Web 9](#_Toc514227424)

[5.1) Conception de la charte graphique 9](#_Toc514227425)

[5.2) Architecture de l’application 9](#_Toc514227426)

[5.3) Connexion à la base de données 9](#_Toc514227427)

[5.4) Gestion de la période 9](#_Toc514227428)

[5.5) Affichage d’un graphique 9](#_Toc514227429)

[4.5.1) Requêtes pour récupérer les données des capteurs 9](#_Toc514227430)

[4.5.2) Script du graphique 9](#_Toc514227431)

[6. Tests unitaires 9](#_Toc514227432)

[6.1) Test unitaire de la méthode loop() 9](#_Toc514227433)

[6.2) Test unitaire de la gestion de la période 9](#_Toc514227434)

[7. Conclusion 9](#_Toc514227435)

[8. Annexes 9](#_Toc514227436)

# Situation dans le projet

## Synoptique de la réalisation

Une image contenant carte, texte

Description générée avec un niveau de confiance très élevé

Au sein du projet, j’ai eu pour tâche de mettre en place le capteur de l’intensité lumineuse pour .. et la création de l’application Web, comprenant le design du site ainsi que la page pour visualiser l’évolution des mesures sur une période définie.

## Rappel des tâches de l’étudiant

Dans ce projet de supervision d’une serre, j’avais pour but de mettre en place un capteur pour l’intensité lumineuse, qui a pour but d’automatiser des stores intérieurs lors de la deuxième année. En effet, les stores assureront un ombrage adéquat pour éviter une forte oscillation des températures. Je devais aussi étudier et configurer le réseau des différents matériels pour pouvoir faire dialoguer tous les systèmes entre eux, pour ensuite me consacrer à l’application Web. Celle-ci permettra à l’utilisateur de voir dans une période initialement choisie les variations des différentes données réalisées par les capteurs.

Dans un premier temps, je me suis concentré sur le capteur, pour savoir comment il communiquait, comment le mettre en place, ainsi que sur la boucle de courant 4-20mA (boucle qui permet de transmettre un signal analogique sur une grande distance sans modifier ou perdre ce signal). Pour assurer cette boucle de courant, nous devions choisir avec l’étudiant

Je me suis ensuite intéressé à la connexion entre la carte Arduino, à laquelle nous avons ajouté un Shield pour qu’elle soit rattachée à la boucle de courant, et la Raspberry Pi 3, qui est la carte de gestion. J’ai donc utilisé la librairie fournie par le Shield pour pouvoir utiliser correctement la boucle de courant et pouvoir communiquer avec la carte de gestion.

Et ensuite, nous avons réalisé avec Samuel, l’étudiant 3 l’application Web. Nous avons choisi de partir sur un design proche du site qu’ils utilisent actuellement, pour faciliter la prise en main du superviseur.

Ainsi, la réalisation de ces tâches a été effectuée en trois grandes étapes (spécifications, analyse, conception) qui suivent le diagramme de Gantt présent en annexe 1.

## Contraintes de réalisation

Dans un premier temps, nous avions une **contrainte financière**. Nous avions donc un budget alloué de 100 euros permettant l’achat d’une carte adaptateur 4-20mA (Shield pour Arduino). Donc nous avons eu à choisir un shield permettant de lire plusieurs canaux, car nous avions initialement 3 capteurs à intégrer à la boucle de courant.

Ensuite, la **contrainte de développement** nous a fait réaliser l’application Web sous le patron Modèle-Vue-Contrôleur dans l’environnement de développement NetBeans sous Windows. Le framework Symfony aurait aussi pu être utilisé, cependant, nous avons choisi de ne pas l’utiliser car les requêtes que nous utilisons restent assez basique.

Et pour terminer, nous avons plusieurs **contraintes de qualité**. La première est une contrainte d’évolutivité forte, ainsi, lorsque l’utilisateur voudra ajouter un capteur, ou une mesure, le travail à réaliser de son côté doit-être minime, voir automatique. Une documentation complète sur le système doit être fournie au client, pour qu’une fois le projet terminé, une autre équipe que l’équipe d’étudiant puisse donner suite à ce projet.

Ce projet va être réaliser sur deux années :

Une image contenant triangle

Description générée avec un niveau de confiance élevé• La première année, où nous sommes, nous nous occupons de la supervision de la serre, qui comprend la récupération des données des capteurs, l’enregistrement des données dans une base de données, l’application Web ainsi que l’application Android.

• La deuxième année se penchera sur l’automatisation de la régulation des différentes données tels que la température, ou encore l’hydrométrie.

## Problème matériel

Lors d’une phase de test, je me suis aperçu que le solarimètre en notre possession ne fonctionnait plus, un solarimètre en notre possession n’étant plus en vente, et notre budget alloué pas assez élevé, je me suis occupé du capteur mesurant la température intérieure. Cependant, vu que mes recherches étaient portées sur le solarimètre, l’ensemble du dossier technique comportera mon analyse à son propos.

# Conception et mise en œuvre

## Fonctionnement du solarimètre

Le solarimètre est un capteur industriel, il doit donc être alimenté pour pouvoir fonctionné. Grâce à ses deux câbles, bleu et blanc, respectivement le plus et le moins. Les mesures du solarimètre vont de 0 à 1000 eeee.

Le fonctionnement du solarimètre assure plusieurs fonctions :

* Il dimensionne la grandeur à mesurer, car un capteur est avant tout un appareil de mesure.
* Il convertit la mesure en un signal analogique.
* Il émet un signal standard de la grandeur à mesurer.

Le principe du capteur peut ainsi être représenté par le schéma fonctionnel suivant :

![Une image contenant capture d’écran

Description générée avec un niveau de confiance très élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzgxAACSkgACAAAAAzgxAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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KKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooA/9k=)

## Fonctionnement de la boucle 4-20 mA.

Inventée vers 1930, par un ingénieur du groupe ESSO aux Etats-Unis, ce procédé est destiné à transmettre un signal analogique à quelques dizaines ou centaines de mètres. Il repose sur le constat que le long d'un câble, aussi long soit-il, le courant continu qui le traverse est constant.

L'idée est de réaliser un dispositif, capteur et circuit associé, dont la consommation en mA sera proportionnelle à la tension que l'on devrait mesurer aux bornes du capteur et de faire en sorte que celle-ci se situe dans la plage 4-20mA, ces limites correspondant alors aux limites d'utilisation du capteur, c’est-à-dire que si un capteur à pour plage de données 0 à 50°C, la valeur 0°C sera interprétée par un courant électrique de 4 mA.

On aurait pu choisir 0-20mA mais ceci peut être problématique en cas de dérive qui décale le courant vers les valeurs négatives, la plage 0-4mA constitue donc une marge de sécurité. De plus, le fait de retenir la plage 4-20mA permet de détecter un défaut dans la boucle si le courant devient nul.

Le principe de la boucle de courant peut être représenté par le schéma fonctionnel suivant :

Pour réaliser cette boucle de courant, il faut 4 éléments principaux minimum :

* Le capteur va mesurer des grandeurs physiques et délivrer une tension de faible amplitude.
* L’émetteur convertit la valeur mesurée par le capteur en un courant compris dans l’intervalle 4-20mA.
* L’alimentation de l’émetteur est une alimentation externe de 24V pour pouvoir
* Le récepteur sera ici une carte de gestion, qui enregistrera les données dans une base de données.

## Réalisation du diagramme de classe

Une image contenant capture d’écran

Description générée avec un niveau de confiance très élevé

# Etude et configuration réseau

## Arduino à la Raspberry

Afin de pouvoir dialoguer directement de la Arduino à la Raspberry, il a été nécessaire de réfléchir au moyen utiliser pour pouvoir utiliser la connexion entre les deux cartes. C’est alors que plusieurs choix étaient possibles.

Des connexions sans fils, et des connexions filaires.

Dans un premier temps, étudions les connexions sans fils qui n’ont pas été retenues. En effet, pour le Bluetooth le choix n’était pas possible, car il aura fallu rajouter un Shield à la Arduino, qui elle est possède déjà un. Ainsi, ce choix a été le premier à être rejeté. Nous avions aussi le Wi-Fi qui aurait été une bonne alternative au Bluetooth, cependant, celui-ci n’a pas été choisi car ne sachant pas où allaient se trouver les capteurs par rapport à la carte de Gestion, il était impossible de savoir si la plage du Wi-Fi allait pouvoir recouvrir l’ensemble du système.

Ensuite, les connexions filaires, deux choix étaient possibles. Nous avions le choix entre le bus de série TX/RX et le port USB. Pour bien savoir comment s’est porté ma décision, il me fallait plus de connaissance sur le bus TX/RX. Le bus TX/RX est en réalité comme le port USB, cependant, il ne nécessite pas d’encapsulation, qui fera perdre du temps à un transfère de données. Or, pour notre projet, le temps d’envoie des données ne nécessite pas un transfert de données élevé, environ 2 données toutes les 30 minutes. C’est pourquoi j’ai choisi de faire communiquer la Arduino à la Raspberry en USB.

Une image contenant équipement électronique, circuit

Description générée avec un niveau de confiance très élevé

Liaison Arduino à Raspberry

## Applications à la base de données

Pour que les applications se connectent à la base de données, il a été décidé en groupe d’héberger la base de données sur un serveur distant, pour deux raisons :

* Nous voulions que l’application Androïd soit accessible de n’importe quel endroit. En effet, même lorsque le superviseur n’est pas sur son poste de travail, il pourra regarder de chez lui l’état, fonctionnels ou non, des capteurs.
* L’application Web qui fonctionne en local pourra être utiliser sur plusieurs PC, par exemple, si l’ordinateur de supervision ne fonctionne plus, il sera possible de le changer et de ne rien modifier à la structure de la base de données, ainsi qu’à l’application en elle-même.

# Récupération et envoie des données

La partie concernant la boucle de courant 4-20 mA a été faîte avec Samuel, l’étudiant 3.

## Choix du Shield Arduino pour la boucle de courant

Pour le choix du Shield Arduino, nous était imposé un budget de 100€ maximum, c’est ce qui a fait ressortir deux adaptateurs :

![Une image contenant capture d’écran, équipement électronique

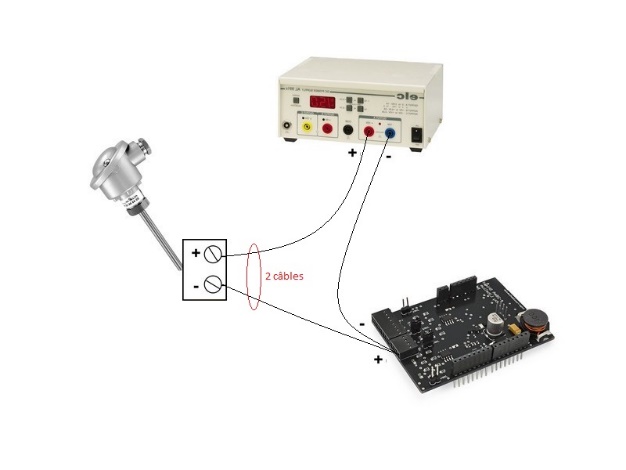
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élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzY0AACSkgACAAAAAzY0AADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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NERUZHSElKU1RVVldYWVpjZGVmZ2hpanN0dXZ3eHl6g4SFhoeIiYqSk5SVlpeYmZqio6Slpqeoqaqys7S1tre4ubrCw8TFxsfIycrS09TV1tfY2drh4uPk5ebn6Onq8fLz9PX29/j5+v/EAB8BAAMBAQEBAQEBAQEAAAAAAAABAgMEBQYHCAkKC//EALURAAIBAgQEAwQHBQQEAAECdwABAgMRBAUhMQYSQVEHYXETIjKBCBRCkaGxwQkjM1LwFWJy0QoWJDThJfEXGBkaJicoKSo1Njc4OTpDREVGR0hJSlNUVVZXWFlaY2RlZmdoaWpzdHV2d3h5eoKDhIWGh4iJipKTlJWWl5iZmqKjpKWmp6ipqrKztLW2t7i5usLDxMXGx8jJytLT1NXW19jZ2uLj5OXm5+jp6vLz9PX29/j5+v/aAAwDAQACEQMRAD8A+kaKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKRgWUgMVJGAw6j86AOE0nxXqNx4/YXNyj6BqU9zYaaoRRsntgu87urbytx3wPJGOpquPFWr614m8JTRWJstHvdUuo4pY70l7lI7a5AEsW0BQxQOo3P8AdBO0gCtO0+FnhTT7bTRp+nRWt9p0sU0epxRRi7lZDkmSXbl9/IbPUMenGJrX4fWFrqVjcjU9Ukt9OuJp7KxeZPJgMqSI6jCBmGJWxuYlcAKQMggGOvxVjH9vJJaadNPpWlXGqLBY6sty4EP3op9qYhkyVGAZB97BOOYPFXjvxFY+EdceHS7fS9Sh0g6lZSfbRNiLJDFgYsCVMqdnzId2N/eptS+GS2XhHV4NIvtR1G7/AOEdutG061uZIVSON0GyMbUTnKKNzEnn5ieMatv8PrObSb621m/1HUG1DTRprtcyoWt4MH5EKqMnLZ3tuY4XLHFAFbxL8Qbjwktn/bdpo8DuiPcRHWgJGBk2kW6NEGmZR8xBEY5ABPOM9/HusaHf+NLrxBb2J0zSb2G3tNt7tKvLHB5aMTEoCMZd7OzHZkgBgoNa2o/De21VZxea/rLG8tore+ZWt1N4sTM0ZciL5Spc/c2g/wAQPObt74Hsb6+1a4kvb1I9W8qSa3jaMIk8Xl+XcISm4SL5SYyxXjlTQBmaP8SYdVVUjhsbiYanFp8kmm6iLq3/AHke8OkoRd2MEFSqkEHtgmS+8e3UUiwafoq3VzJrzaLGj3nlqSIGl81m2HC/LggAnGSMnCnSufCT32kCz1HxDqt1PHdR3VvfMLdJrd0II2hIVQjqCGVshiPpDY+AtPsvsrG+1C5lt9VbVjNPKrNLO0LRNuwoG0hydqgAHGMKAtAFzX9WvbDRoIbSOMazqDLbWsakyJHMwyXOQpZIwGc8AkLjgkCsnwj4vtR4P0STxVr1mmpX++ONrqWKB7plkKfKg2gn7owo7j1rotW0DR9fhji13SbHU44m3RpeWyTBD0yAwODVfwv4X0vwfoaaVokCw26uzkhFVnZjyzbQATjAzjoAO1AGBeajq+h+M4o31ibVYHs7q8vbFreJI7SJeYmRlUOCWBT52bd85AG04r+HNW16LUvDMmrau2oxeI7GS4lt2t4o0tJQiSgRFVDbMMy4cueFOeudnS/Bf9laxeXy+INUuUvp3nurW5S1eOYsCArN5Ik2qMBRv4AA6cUug+CLTQby2nTUdRvksbdrWwgvJEZLOIkZRNqKW4VBucu2FAzycgGb4i8f3uialq0dvoIvLPRkt5ryf7aI3KSnH7tCpDOME4ZlBx94VO3je6tNJ8RSaxpkNnqGjRq628N156z+YmYgGKphmfKbcYz0Yg1oan4M0/Vf7a+0TXS/21FDFcbGUbBFnbsypweec5/CotV8CaPrd9d3Gp+dcRXk1tLcWrlTDL5G7YrKV5XLZIJ5KjtkEAZ4G1LU57O/0jxHdi81jSLnybmcRrH5yuokjfavA+VwvHdGqtpcmt+Jb/UNRt9el022stRls4LGK2hkikWFyjtKWUuSxDfcdMLt75J1NG8G6J4d1i51DQLKLTBdQJDNa2cSRQPsZir7FA+f5mGe469BWFJYxQ61c3djL4lsLe5nEl7ZWqR+TLcemWQyKXAGWjdU6HIJJpOSW5pTpTqfCjQi8bebDYSf2fj7Zr1xo2PO+55Tzr5v3ec+Rnb23dTjnLj+IWrzaHBqkXhqEx32oDT7GM6lh5H3uhd/3eETcnYscEnGQAYU0Kxi1qK+ZfEYhttRfUEsAqGCC8k3blAC7mDF2OSxQFuCuatQ6fp9to+m6abDWhDpd99rVvLUsLjeziI4GGUlz8wG3G35qn2kTX6rW7fkVr34rw6b4ibSr2HSo5LWe3tLyL+11Fx50oQnyIWjDTRr5iZclCcPhTtwbsPjzUJdWKHQY000au+kG6N9+8MwLBXEWzHlkhQSWDAk/KQMlHi8rXptTsJPEWmC4lR7+0treB4Z7hVCgNvjZssiIpdGVMBeQSTSJZWEURjaw1oAaqdTk/dqdt0W3CLgcqT/ABD5eR8/NHtIh9VrdvyLXw51nXtc0S8uPEcVqrx6hdQRPbzlyRHcSJtI8tAAoUKG5LAZO08V11c34SsI9Ol1GO1/tJIZ7l7l7a8SMR200js8ixlVDMCzFsksvI2nqK6SqTTV0YzhKD5ZBRRRTICiiigAooooAKKKKACiimyRrLE8b52upU4JBwfcdKAPKvDPjy1v/idui8RQ3lvrk91aQ6YLxXNobbAicRg5QSCOdiSBndH7CrNvrGsa34g8F6zqTWEem3l7dy28MUTpLboLacLvcuVfK8kgJtIx82cjuv8AhGtIGk6dpq2SpaaY8MlnGjMvktF9wgg54xg5PIJByCapW3gPw5aapHqEOnnz4ZJZIQ9xK8cBlDCQRxsxRFfe25VABOCRkAgA4z/hZ+qx6fr06myvDa6FJq9lImm3NvCCmfk3ykfaEOVIlTYCATgbhhfGniDxXa+GNfspr6wtrtdIXUbe5sYJUaFS5V4s+ZksPl2yDbn5vkGK3NX+Gelf8ItrNl4ehaHUL7SZdNgmu72eVYo2X5YxvZtsYIBCqMDnA5OdW08C+H7bTL6yNiZY9Rtha3QmuJZd0QBAjUuxKINzYVcBc8AUAc/4p8a6t4XliikvLC8mtUge8ht9Jun80SS7eXV2S1G0HaZGfcQemOc7/hJ/EPh6Tx1qN3ew6hDa6tBZ2dsLSZjE8yWyoQBIxKL5uTGq5ZtxBBYKOtu/h54cvypvba7n/dpG4k1K5YThGLIZQZP3rKTkM+4jAweBi5c+EdFu7zUrm4tZHfVI1S7X7TKI5doUK+wNtDgIuJAAw2jB4oA5zTfGmtSLDHe2obfq8Nkt3LpdzYrcRSRliywzHcrKwK5ywOM98Bl54z16XUYtP0xNOjmn8RzaSstxFI6pElq028qHBZsr0yARx8udw6NvBujy6O+mXAv7m3eZJw1xqdzLLHIhBVklaQuhBAPysO/qaLDwVoGmC2+xWBQ2t419EzTyM3ntGYmkYsxLMVY5LZySWPPNAGf448RR6FotnZXmsWul3eqSC1F/LKtukA25llUuSAQoO0En5ioORk1n/D3xfZT+A9B868vdUuLhTC1xBBPe7XDYxLKisEOGXlyOOeld7VTS9Ms9G0yDT9Nh8m1gXbHHuLbRnPUkk9aAOIvGn0nxheTaFqGo3psNPurnV1ubySaESMoeCIISUjfgttRVwmM/eXLPDQutN1zwq66pqF//AG7pU09+t3dvMjSKsTiVFYkRcyMNqBVwwGOBXTaX4J0XRtQe804ahG8k0s7xNql08LySZLs0TSFCSWJ5Xrz1qTRPB2h+Hrs3Ok2kkUnleQnmXMsogizu8uJXYiJMgfKgUfKvHAwAcx4l8ZeI9M1LXn0yHS3sdDNozRXCSebdCbbuUOGxHjJIba/UDbxkmp+NtS0Lw74rXXrnThf6UIo7a5gRreFmnRRFuDs+MSE5bONozgc11t34Z0i+/tD7VaeZ/aXlfa/3rjzPL+50PGMdsZ70k3hjR7nVDqE9mHumuIrkuZGwZIlKxttzjgMccYzg9QCADnvhlrlvf6dqejwa2NdOjXZhTUPtQuDcQuBJGxkBO4gMUPf93zViEXVt8XmhfUr24t7jR3m+zyy/uoiJkACooC8An5iCxzgkgADpE0qyj1mbVY4At7NAlvLKGPzopZlBGcHBZsHGeTWb/wAIdpB8SjXj/aH9ojID/wBqXOwKTkp5fmbNmQDt27fagDL8PJdxfEDxVZT6rfXaC2s5YzcSBvKZ/PzsQAIvCqOFGdoLbiSTmeGoLmPxXquiyXGvaXFcaWjQwanfm6uHYO6yXMcm+VE+9GNobrg7F4LdHbeBtDtdVutRRL6S4vEMdx5+qXMyTIQw2sjyFSAGbAx8uTjFFv4G0G2tL23EF3Mt9bfZJ5LnULieQw8/u1kdy6LyeFIoAo+B1f7frcmn3d5daA00a6fJeXclyXdVxM6SSMzmMttA5xlXI4OTL40mml1Dw3oyXNxa22rak0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Ri5mjEZjNtbnaAqrxL5fndFHBkK+3TFfVPh9Y6y2qtqV/dXB1Mxbg9vasIljfeihTDiQDOB5okwM4wSSbXiSRP+ESUX0st3cTNHHbjTbmWzNzMxwgVo33KpJyfmICgseAa5tUj07xD4f8ADsHiN7++sSv2pf7alkugxzI5kt85eNgQN0rsEUqFXJyQDrLDwtYafprWUeXhaxSxZfLjjXy138hI0VVJ8w5wAOBwKrL4KtI9KjtIr++SWJflvN0Zm8wzLM0vKFSxdFJyu3AAAA4pnjK9t4dHuobvxPpugRyiOJZ7qUxFJC27G9Zo2+ZFYAKytwSDxWU3iG48L/DOyvIo2ubwZZLe4e4lku4wxZ2Xe0koJjDOAxfaMKelAGn/AMIFp7eJdP124uZ7q+soVi825gtpXmI3fOZGiLocuTiNkX0AHFdEbfe04mmkkimUL5TbQqDGDggA8+5PtiuS8YXkR8K2MGp+LNN0e7uSJFmWSWNbvA5SJY545W5ZSArkngYOcVDaarZHxT4Z0yfWmtNSjsDJLo8mqb3VvKHyOpO+ViJN2XJ/1W4Y+YkA6DQfDiaGXeTUr7U5mjSFZr0x7o4l+6iiNEUDJJJxuPGScDC2nh4WesSXkOqX4tmkeZdO3ILdJHzucYQOcks21nK5YnGQMZy+Jbu4+IJ0O1azNksRla4KOWLpxJAD93eN8TZzwCw2/wAQg/4SHRU+Id95nie3H9n6cxurSTUUEdvlxkmPIAK7CSzZI8zGQCBQBqweGI4NeOpNqV9KiyvNFZO0fkxO6kMwwgYk5P3mbGSBgHFXb/SLbULe9jl3o17am1llRvmCYbpnIBG9j09M5wK5XwXqYj0DW9Xlvvt1tDI0gkh1GS+hfZEGdo5mA3AkkEIiorAqF+UklprPi6G/jj1ifQxGlxBDOkFtKDvdN8kSu0uB5afN5hB3g42JjJANC28FPZWbQ2XiTVraZyokuYYrRXeNV2pHtEGxVUdNqg+/TGvNodnL4fGjRh4LVIliiMb/ADxbcbGDHPzKQCCc8jnNcnB4h8XO0c88ujRW8i2Uxi+ySmRFnlMYh3GUAuRg78AKeNr5yO5gniuYVmtpUmib7rxsGU/QigCtpWnSabatFcajealK7l3uLwpvPAAACKqKAAOFUdyckkm7RRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUVBfPPFp9xJZxGa4WJmiiBA3uAcLk8DJ454oAj/ALV0/wDs1tQ+3232Jc7rnzl8sYO0/NnHBGPrVuuCj8JalFYHQxCP7HtZ4Bbosinz1by/OZgegX98QOclgcZUZjFj4l+3ajepZaxHMBJHNu1NGS7Vpl2/ZYvNMce2JWwziJslc7iXIAO/WWNpHjWRS6Y3qDyuemR2pFmieZ4kkRpIwC6BgSoPTI7Zwfyrz+ztPEuiWLz6ToWoyy3TXMkdrc6qs7wvsjSAzyySsWGFckKZNpbAyADUfiLQPE8hit9La+NrPdH7RJDN++CJFFHGxkW6gfB2yufmY5blDQB6PUVzcw2drLc3UixQwoXd26KAMk1x3i+HUr/UrTSdMTV7jy7RjJJZX62qxyOwWKWZw6OVBSQkIGJ5+U9DW8S6F4jktb6/0u41KW9uroRG2jum2xWqqF/dxi4hVWZkVywkVwHYA9VoA7mzvIdQsYbu1YvDOgdCylTgjupAIPsQCOhoju4Jbua1STM8AVpIyCCA2dp9wcEZHGVI6g1yvh/QLmz8TRXN/HqsrQ6VBEl3Nfs0TPufzEaLzmJb5l5YP9377HJJ4bsNX/4Sie/1K01S1HlSrKbrUvNhnkaRSpigWRlRFUEA7VYg/MM8kA6pLy2kuGgjuImmXIaNXBYY25468b1/76HqKmrhte0XWj4Ykm0qCb+15bmbe0TAzLbyTbyikTQjO1IlJEikBcg5ABYvhXWbmxs1n1LWYXgitVXZqDRlW80vOzASPvwjbAHeT7vJf71AHeUyOaKV5UikR2hbZIqsCUbAbB9DhgcehB715zeaZrDzwaJaLrzfZo7hklj1cgQ+dcP5Ek8jS+bIESIkKC/3iCMYAs63pGvXU0yQ2epk3k07xy2Worapby7hHFLMVkV2QRKhCqH/AItyZC0AdRLZ3893O1nrYUQvlIfKVxG5AJWTnLLgggfKRuzk/LhP7J1ZP9XrsjeX80XmwKdznr5mMbl64A24z1OBifSlvY5bkXyTkzTySK7OrIiA7EUYORlVD4xjLHPNaVRyL+mdCxNRK2n/AICv8jOsdPvba4zcapLdQKCVR41DFj1LMOo9AAMZPXjGjRRVJWMpzc3d/kl+QUUUUyAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiquqG6XR7w6chkuxA5gQEDdJtO0ZPA5x1oAT+1dP/ALNXUPt9t9ibG2585fLOTtHzZxyTj61brhYfCt/FCmkJbhNH0++je0USKfNVpFkkdh1CqDJGF77icfKhqtFYeJfIurtrDW0uHhWK8h/tVGN2zSx72tV87ZCoQSBTmJvnBxuANAHoCSxyNIscis0bbXCtkocA4PocEH6EUJNFJJJHHIjvEwWRVYEoSAQCOxwQfoa8/t7HxLpmn7dO0jUPPvku1IfVFm+yszIkTyySSFnYRRqRt34JYZA5pniDQvE93qNslib63s7q9me6azlw8eCkUUjOt1C2PKTcBiUEsdyEhcgHo1Q3l5BYWct1dvshiXcx2kn6ADkk9AByTwK5DxfFqWq+IIdO0yPVf3VmWMllfC2iiklfEcs2HV2CeU52qGzuII5qj4n0HxK9lPd6VNqk13eX7ie3iu2Ijtl3CNY0FzbhASqOWWQPlipypKgA7nTltHtzeWHzR3xFyZMk+ZuUYbnn7oUY7ACpIruGe4ngifMtuwWVcEFSVDD6jB6jjqOoNc14e0Gaw8T3N1eJqkjpZW9tHdz37PFOqrzmLzW+cMTkle+QxLMTF4QsdXXWLm91a01SzLW6rKL3UvPS4nLEu0USyOkUa4AXG0kMQVGMkA6qO7tpZfKiuInk+b5FcE/KQG49iQD6ZFTVweu6JrY8IQPo9vMNWnlZrtYXBlSOR3leNSJ4QCHZQSsqnAOCehd/wimrXUVqJ9U1mEwJawKU1Bo8KpLzSMBIxcsGMXzs5G0HJI3kA7qmRzRSvKkUiO0LbJFVgSjYDYPocMDj0IPevOptN1mW+ttIhXXW+ywu0U8erER2zyzuY2uHMvmTFI0XCfOG3EMBkGrGpaPr1xPJClpqYNzJLLBc2eorbpaytK4WSfbIrSKsQhwgEgOGDDoaAO5lIuoZ4be58uVTsZ4iC0TYBGQc84IOD2I9azf7J1Z/9Zrsi+Z80vlQKNrjp5ec7V6ZB3Zx1GTmfSBep9oS/im3vNJKsjurKFMjBEGCSMIqE8Y+bqTkDSqXFPc1hWlTVo2+5P8ANGN/ZOrP/rNdkXzPml8qBRtcdPLznavTIO7OOoyc6NjDcQW+L25+0zsSzuqbFHsq84A9yT71YooUUhzrTmrO33JfkgoooqjEKKKKACiiigAooooAKKKKACiiigDmPGXjBfCy2aJ/ZrXF35hjj1HUDaK4QDKoRG5dyWUBAMnPtViHxhptxc/ZYfO+1JIIpo2tpcI+wu0YcIVeRVUkoCTx24rXNlGdUW+ZnMiwmFVJG1QWBJHGcnC55/hFUJ/DsMtokEd3dwGOaaZJYmUOrylizAlTg/vHA9AfXBoAk03xFpesaZLqGlXJvLSNd3nQRO6uNob5MD5zg4wuTnK9QRVLxX4nPh3Tree3gtrie4k2RW9zdfZ2mOM7IxtZnkPQIF57kVc0zQYdG0YaZptzcwwLIzxEsrtEGfeUBYHK8kc5IB68DDdY0FtZmQTatfQWW3bPYQiHyrgZyQ7NGZBnodrrxQBTvfF8VrrhtIrV57S3jme9u03N5JjTcVRFUmRhwCBjBZQNxyBlL451qXw5JrUPhhxbySKlrBJ9rFwQScmWJbVmTA7oJFJP3sfNWnc/Dzwld6tNqM/h7TTcXEU0U7C0jUzebjezELkscEbs5+ZvU1BpvgZtI0OHSdL8SapZ2kTsQttb2UOVbqnyW4AGcnKgNlid3TAAn/CYXzJaz2+l2txaZtUvLiO+O1HnKBVhBiBlwJEYlvL4ZcZOQNG98Y+HtP8AENtod3rFjFqVwwVLZ7qNZATjaCpbOW3AKMZOeKih8HWdvqMc0N5eJYxtFIulhk+z+ZGioj/d3naETAL7cqGxkZrba1ha8S6ZMzxxtGrZPCsVJGOnJVfyoAwdY8S3mneKdP0mDTUkgutnmXk7TxxpuYjarJA8ZfA4V3TJKgdayk+Ic8+m3+sRaQttots4ijutTlmsnd2cIrsskAVYcncXDsQvJXd8ldBdeHvt+r/ar/U725s1ZXTS3EItlcDAbiMSNzlsM5GTnHAxl6V4Ag8P2N1Z+HNZvtItrifzlis7WyUQ9eBm3JbjAy+5sKvPXIBSh+IV3eaDJf6Zpmn3zWsU1xeSW+qbrVYo2YZimEX7xm2tgFVGUcFhgbui1bxRpWhyW0epzSxy3KNIkcdtJKwRdu92CK21V3rljgDPJqi/gey3RpDfX8FqYhFdWqSIyXwDvIfNZlLks0jltrLu3ENkcVNqXhqXVtea6uNSuYbE26QNZwFNtwAzM6yFkLBTlRhGXODmgCV/F2jR39zaPcTB7aOR5Jfskvknyxl1WXbsdl5yqsWGDxwcSan4n0rSCFvZ5fMNwtssUFtJPI8pTzNqpGpZjs+Y4BwOTiqDeCoJPtom1bUpI7gTiCNmi22ZmYs7RgR/Mcngyb8DIHBYG5pXhuHTJlne+vL643ySPNdupaR3CKWIVVAIVAAFAABIx0wALqPiS00q+mgvFk2QwxSHyInmldpGdVVIo1ZmP7tycA4AJ6AkSNr1vJpFpqFirTR3c8UUSyK0LEPIFJ2suQQNzYIGdvbrUGp+GU1G4NzFqd9Y3PnrKJrbyiyhY2j2DejDaQ7HpkFjgipl8P28elabYRXFyiacoEMgcF2xE0YLEg5OH3Z/vAH2oAii8WaSbCC6mu0VJjtUorsufI8/rtBx5XzZIA7deKgj8c6FK1oI5L4/aygiP9mXOAHfYjMfLwis3Cs2A2DgmiTwVpj3cs2+4VJLH7CIFZRGiEBWYDbneVVVyScAcYyczXXhiO71wag+pXyReZHM9ijRiGSSPG1m+TecYHy7tuQDjPNACp4r0z7ULeaVlcrLI0iQStBHGjON8k2wJGD5bfeIBIIBbgmD/hOdC+yG4eW8jHniBYZNNuUmdyhcBYjGHbKqxBCkHacdKgl8CWk8qmbUr5o0sGsI49sAMaMgVm8wRCQk43EMxQtg7eBi9YeGY7OZbi41K+v7sO0jXN0Y9zMU2A7URUXauQAqgfMxIJJNAGpZXkOoWFve2jF4LmJZYmKlSVYZBwQCOD0IzU1QWVpFp+n29nb58q3iWJNxydqjAz+AqegAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAK4qD4j2ba7qVvcnTxp+nmZZp7a+M88DRyCPE0Cx/u9zFgvzMTjgdcdrWemi26aXb2BklaOCVJtxI3SOriQFiB3YZOMUAZ8njbRbeIzXty1tGz+XGstvMkryeWsnl+WyBhIVddqcs2cAZyK2zcILiKErJvlRnUiJtoAxnLYwp+YYBIJ5xnBxi3nhG0vr5Lua8vlkjuhdxhJVULKCPmxt5+RRHzkbMgckmtsROLppfPkKFAohwu0EEnd03ZOcdccDjrkA5m88T61Ya/eWkuhWtxZ2tlLemW0v2kn2Lny1MRhUBpCrAAOR8jc8c5y/ES6bTbUxaMl3f3100Nn9gkuLmzkjVVJmNwluSI8ttyIyC2P4dzrvXvhKzv8AStTspbi4DalcCee4Ijd8qylFAdChVQqqFKkYHOSSTl3nw00q9+xXEl3cf2rZ3DXCaq1tayXDOxBJw8LRqcqpBVFIK8EZOQCSfxjf2MizajpFvHp0LmC7uYr1nZZhGXbyk8oeZGpG0sSjZDfJgZOloetajf6hd2Wr6XHp80MMNwix3XnZjlMgUP8AIu1wYjkDcORhjVabwVbXM119q1PUJradZ/LtGeMR2zzKyySIQgbcQ7/eZgN7YArS0fRRpKzvLfXWo3dwwM13eFPMcAYVcIqqqgdAqgZJPJJJANKiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKAP/2Q==)

L’adaptateur numéro 1 possède 1 canal, donc il aura fallu en prendre 3, avec les frais de livraison, la contrainte budgétaire aurait été dépassée (113.40€). De plus, pour faire fonctionner cet adaptateur, il aurait fallu rajouter une carte d’interface 8/8/8 qui aurait rajouté au prix initial environ une centaine d’euros.

Notre choix s’est ainsi porté sur la carte numéro 2, dont le prix est moins élevé, de plus, elle possède 4 canaux. Ayant 3 capteurs sur la boucle de courant 4-20mA, ce choix était le mieux adapté.

## Mise en place de la boucle 4-20 mA

Pour mettre en place la boucle de courant, nous devions dans un premier temps attendre le délai de livraison de l’adaptateur 4-20 mA Current Loop Sensor Board. Une fois l’adaptateur reçu, nous l’avons placé sur la carte Arduino Mega 2560 comme précisé sur la documentation où l’adaptateur a été acheté. Nous avons reproduit la boucle de courant en suivant le schéma fonctionnel de celle-ci.



Alimentation (24V)

Capteur

Adaptateur + Arduino

Schéma du montage

Pour ensuite tester la boucle, nous avons inséré un programme dans la carte Arduino pour récupérer le voltage. Pour ce faire, nous avons utilisé la bibliothèque fournie avec l’adaptateur.

float currentLoop::readVoltage(uint8\_t channel)

{

return (readChannel(channel) \* 50. / 1000);

}

Il nous suffisait ainsi de modifier le channel (1,2,3 ou 4) avec celui qui correspondait, et on s’est aperçu que les valeurs variaient en fonction des modifications effectuées aux capteurs. Malheureusement, ces valeurs variaient même lorsque qu’elles ne le devaient pas, nous nous sommes ensuite aperçus que le jumper de l’adaptateur n’était pas enclanché, ce qui provoquait un mauvais fonctionnement de la carte. Une fois le problème réglé, tout fonctionnait.

## Test du solarimètre

Pour tester le solarimètre, nous avons utiliser un Superviseur ARIA. Le superviseur ARIA est un prédécesseur à notre projet. Il s’agissait d’un automate permettant de superviser des données, cependant, son logiciel n’était disponible que sur Windows XP/95/98/2000.

Voici un aperçu du logiciel :

Une image contenant capture d’écran

Description générée avec un niveau de confiance très élevé

On peut ainsi remarquer que les valeurs présente sont leurs valeurs reliées à l’automate, ici, il s’agit d’une image prise sur Internet, d’où le nombre de capteur présent.

Pour mettre en place ce superviseur, il faut brancher les capteurs sur l’automate, qui gère lui-même la boucle de courant 4-20 mA. Voici donc les branchements effectués pour la mise en place du superviseur. Et ensuite le relier à un ordinateur possédant le système d’exploitation XP.

Câblage du superviseur ARIA

Une image contenant intérieur, table

Description générée avec un niveau de confiance élevé

Capteurs

Centrale pour

Automate M16

Automate M16

Nous avons ensuite testé de mettre le solarimètre dans la boucle de courant 4-20 mA, pour essayer de voir une variation au voltage de celui-ci, or, avec différent éclairage, les valeurs ne variaient point.

C’est pourquoi j’ai décidé de trouver d’où venait la panne dans le solarimètre.

## Détection du problème

Pour détecter le problème, je suis tout d’abord parti du principe que l’automate fonctionnait, et que le capteur lui aussi, car il avait été testé l’année précédente.

Le capteur une fois brancher à l’automate, j’ai utilisé un Voltmètre pour voir si le capteur fonctionnait toujours. C’est à ce moment là que je me suis aperçu qu’il ne fonctionnait pas.

Pour aller plus loin, j’ai décidé de démonter le capteur pour voir le problème. Avec l’accord de mes professeurs référents, j’ai coupé les fils qui reliaient le capteur en lui-même à l’oscillateur.

Une image contenant intérieur, blanc

Description générée avec un niveau de confiance très élevé

Capteur

Oscillateur

Une fois les fils du capteur relié à la boucle de courant, je me suis aperçu que le courant variait sur le voltmètre. Le professeur de physique et moi-même avons donc conclus que l’élément qui ne fonctionnait plus était l’oscillateur.

## Récupérer les données d’un capteur sur la boucle 4-20 mA

![Une image contenant capture d’écran

Description générée avec un niveau de confiance élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzYxAACSkgACAAAAAzYxAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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v7clhkk0y6tlt7p4kLm2ZGJVyBztIbBI6YB71z0/iyw07xPJL4KurbX/7XUmSxsJ1lMNwB8srYPyIf4icYxnkmvS6aqKpJVQM9cDrViPG9a8I6jo2oeF7FvFGpbltbrAWK22wkeVlUzCSQc/xFjwOeue30zw1q7aXblfHGuICgwot7HA/O2qn47/5HDw5/1wvP/aNdfpP/ACCbb/rmK8GlJ/2zUj/cX599zskv9mT8zh9d8O6q3ibw9av4z1qXdNLMrPBZAxlExkYtwM/PjnNGieHdVXxZ4itk8Z61HtmhkLrBZZkLRLknNuRn6AfnXQa1z488Nr28q7b8hH/jRpXHxA14esVuf/Hcf0r3jjD/AIRjWP8Aoetd/wDAew/+RqP+EY1j/oetd/8AAew/+RqNR1XUrPxppthDPbz297uLWogIkhjVeZC+4g/NxjA6+1ZNz8V9ItNXk0ua0uheI7IY8LywmEQXOepJyPbmgDW/4RjWP+h613/wHsP/AJGo/wCEY1j/AKHrXf8AwHsP/kasO3+KdpFZtJe2k5CBC0zGKJNzsQqfM/B4JJJxgfhXX6DrUHiDRYNStEdI5gflfBKkHBGQSD9QSKAMz/hGNY/6HrXf/Aew/wDkapLDwtNba5BqmoeINT1Wa3ikihS6S2RUD7dx/dRISflHUmugooAKKKKAObv/APkpGj/9eNx/NK6Subv/APkpGj/9eNx/NK6SgAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigApj0+mPUT2GiB6ryVYeq8leRXOmBk+Af+QPqX/YYvv/AEe9dRXL+Af+QPqX/YYvv/R71cvdK12fxPa31p4ja10uIYm0wWUbiY88+YfmXt09K9en8C9DmluzL8YeLG0vU7bSbe4NgJE8271NrcypZxkkLn+EFiD8zfKMc9RUkum67p9l/aWieJLrWCq+YbW9SBo7leuFaNFKsR0IO32pdYk/4R/xQ2s3UDy6XeWy213IiF/s7KSVdgOdhDYJ7Y561zl3qmlaVIJPhnrdpd3dw3GiWri5glJ/i2of3HqWBC+oJqxE/iXUodY1nwlqFrnybmzu5Ez6EQ13ek/8gm2/65ivJNZ8EJpGoeFrKbUtTMptbrzSl9IFVh5Wdgz8oyeg9BXcaZ4Ltn0u3Y6xrwygOBq04H/oVeDSUf7ZqO+vIvzOyV/qy9S3rvy+NfDbnp/pKfiVT/A0aN8/jrxGw/gNuh/79Kf61z3ivwhbWR0i+/tbWykOoIsrPqkxKo4ZMgluDuKjNHhbwhb31xrN9/a2thJb940dNUmBcRgR5J3c/d4PpXvHGdj/AMI5pw159ZVJ0vnADul1KquAMAFA20j2IqCXwdoE2qNqMumQtdtcLcmU5yZFXaG69hVb/hCbb/oM6/8A+Def/wCKo/4Qm2/6DOv/APg3n/8AiqALK+DtBS3khTT1VJQu7a7A/KcqQc5BBJ5HNa1tbpaWyQRGQogwDLI0jfizEk/iawP+EJtv+gzr/wD4N5//AIqj/hCbb/oM6/8A+Def/wCKoA6Siub/AOEJtv8AoM6//wCDef8A+Kqpp1i+jePUsodR1G5t5rAyNHeXkk4DB8ZG4nHFAHX0UUUAc3f/APJSNH/68bj+aV0lc3f/APJSNH/68bj+aV0lABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABTHp9IVzUyTaGis9V5KutDn+L9Kja03fx/pXnVqFSWyNozijidD1fU/DkeoWc3hXV7wPqNzcRz2slpsdJJWZSN86t0PcCtI+OLsdfBfiD/vuy/+Sa6BtP3f8tP/AB2om0kt/wAtv/Hf/r1nKpj4q0IL+vmVy0XuzCPjy4HXwZ4g/wC+7L/5JqJfHjRElfBWvKScnBshk/8AgRW62hlv+Xj/AMc/+vUf/COZPzXPHsn/ANeuSeIzlfDRj/X/AG8aKGG6yf8AXyON1HU7zxX4t0eSHQNS0+K0iuFeS8aAgmTy9oAjlc/wnsK9JtoRb2scQ6IoFV7LS7ax5iXc56u3Jq5XbgsLWVSWJxNvaSSWmyS9evcyq1IuKp09l3K+oWFtqlhLZX8Qlt5hh0yRnv1HIOecim6bp1ppGnQ2OnQiC2hXaiAk4H1PJ+pq1RXqnOFFFFABRRRQAVzc/wDyU21/7Bjf+jK6Subn/wCSm2v/AGDG/wDRlAHSVi654j/sa9srOHSr7VLq9EjRxWZhBCpt3EmWRB/EO5rarm9W/wCSieHP+vW9/wDaNAHP3viTUm8f6VKfBuuK62c4ERkstzZKcj/SMYHuRXQf8JTqv/QjeIP+/tj/APJNF/8A8lI0f/rxuP5pXSUAc3/wlOq/9CN4g/7+2P8A8k0f8JTqv/QjeIP+/tj/APJNdJRQBzf/AAlOq/8AQjeIP+/tj/8AJNH/AAlOq/8AQjeIP+/tj/8AJNdJRQBzf/CU6r/0I3iD/v7Y/wDyTR/wlOq/9CN4g/7+2P8A8k10lFAHN/8ACU6r/wBCN4g/7+2P/wAk0f8ACU6r/wBCN4g/7+2P/wAk10lFAHN/8JTqv/QjeIP+/tj/APJNH/CU6r/0I3iD/v7Y/wDyTXSUUAc3/wAJTqv/AEI3iD/v7Y//ACTR/wAJTqv/AEI3iD/v7Y//ACTXSUUAY+heIRrc19BJpl7ptzYyKk0F55Rb5lDAgxu6kYPrWxXN6B/yOniv/rvbf+k610lABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAUUUUAFFFFABRRRQAVzc/8AyU22/wCwY3/oyukrm5/+Sm2v/YMb/wBGUAdJXN6t/wAlE8Of9et7/wC0a6Sub1b/AJKJ4c/69b3/ANo0AcHqMCvqF9cyJ4qPiOPWGS0eNdR8hbc3K8KV/chDGDntjrXo3iRvE6wQf8IjFpUku/8AfjU5JFUL/s7AefrW1RQA2Pf5a+btD4G7b0z3xXnHxKbUxrEB00TFIrB5XaO6ki8rDr84C8OwGTtJAP6V6TVHUdZsNKaEahKYRMwRXMTFAScAMwGFyTjkigDziL4g+I2nmQW9vDBHKIpJLhF32qbsCVkEm5gRzkqoBPcVHD8TNYFrK00lnKWIS1kSBlE7/a/KOBuP/LPBx+Ndbr3jDw1HpKtdXFzPFOU2rYpL5hBfYGBTBA3e9OtfE/hDQrOS1gvEtobbJYGKQ5bcA2CRl23MAQMkE80AcTF431jTdM0zT7R5Hu7jcJPPg3N8xfDKxfJIKjgKR6mrVp451+30u1zdWt3OIYSkbW7GS9Zmw4UhsAp34/hOetdvZ+NPD+oSSJZ3jyyRKWaMWsu7g4IC7ckg9QOR6VX/AOFgeHRfC3+0Shfsy3In+zP5e0sVC5xkNkY24znjrxQBljxRrUHgnSNTvpbWCfUJ1We4a3YRWaEMcld3sBkkDmuS0TxfrenaYk7TxSALGZZZg5klUs2fLRnALdOM5x616M3jzwyJIom1IB5BnaYJPk+bZ8/y/J83HzY5roQFIGACO1AHjd54613VtKlhiuYZvMk/eJaQPFNZhbiMLuO4/eBIxgdDU938VNYtbi8mt7VbnT7UqDut9kgL7lVSA7Y+dR1wcNyBXqtjp9rptuYLKFYoyxcqOeSck8+9Ralo9pq32db5WeOCUTCMOQrMOm4D7wB5we9AHJ+IfFGt6Pa2IZrWCZ7Fp2aWBnFxOOkCYYYJ/E8+xrW8E6tq2uaXcXusrHC32mSOOBIipjVTjkknJ/KukIB6iigDm9A/5HTxX/13tv8A0nWukrm9A/5HTxX/ANd7b/0nWukoAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACubn/5Kba/9gxv/RldJXOazpGsyeJLfVtDnsVaO2MDx3cbsDls5G0igDo65vVv+SieHP8Ar1vf/aNG3xv/AM9dB/78zf8Axdc/qa+MP+E80DzJdE877PeeXiKXbj91nPzZ9MfjQB6JRXj0jXwivf7Qk8UHxJ/bGIxaDUhZmL7Sv3QP3Pl+XnrxjrWz8WV8atBpw8KraNafbrcvhZjPv3d9nHl/3qAPSK5rxV4Kt/FdxayXd9cwpbsreVGEZWKuHBwwODkYyMHFbWlf2j/ZcH9t/Zft+3999k3eVu/2d3OPrXHeM7DVdW8W2NjpUzQ77KRvO+0yRLCwcYfCffI9CQKAJD8MLT5wNXvdgRUt12x/uAsvmDHy/Nz654qS7+GlleqIrnUrxreOUzQw4QCJ2kV2IO3JyUAwScAmuZuPiTrMOoXdtbyWzW9oEZ5riEJKRudWVU8zDOdoIVipOemcU+98Z+ILzUhZ2Yt5rpLndbiKNvLVdjlQ5D5D/KAUYcZzzxQB0t38OLK5kmkTUb2B5ZZ5S0ZUYMrq7DpyPlxjuCc1Xt/hZYWsMKQ6ldoYohGGVIxyJTIrYC4GGJ4AxisJfiL4lujaT29jDb2147CA3MaoG2sFKlnkTGfmIxk4I4rR8UeJ9c0HxNe3EdzGbG20+G6axaLJdN5EpRs8kDmgDUT4b2Pm3081/dzXF/EEuJW2AsfNMu4AKAOTjHpXYInlxqg5CgCvKLX4ieJJLseb9iaVhbyRaYtu3nTJIMkBt3GBg5x9etdP4D8T6v4ja7bVIIIo4wCqoUV4nycoyCRiMccttPPSgDsqKKKACiiigDm9A/5HTxX/ANd7b/0nWukrm9A/5HTxX/13tv8A0nWukoAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigArm9W/5KJ4c/wCvW9/9o10lcv4lXULbxRomqWOj3eqQ2sVzHMlo8KuhcR7T+9kQEfKehoA6iiub/wCEp1T/AKEfxB/39sf/AJJo/wCEp1T/AKEfxB/39sf/AJJoA6Siub/4SnVP+hH8Qf8Af2x/+SaP+Ep1T/oR/EH/AH9sf/kmgDo9o9B+VGB6Cuc/4SnVP+hH8Qf9/bH/AOSaP+Ep1T/oR/EH/f2x/wDkmgDo8D0H5VT1XSrbWdPeyvd5gkI3qjld4BztJHY9x3rI/wCEp1T/AKEfxB/39sf/AJJo/wCEp1T/AKEfxB/39sf/AJJoA2bfTLO0u5bm3gWOaZVV2HcKMKPwFWwAOgrm/wDhKdU/6EfxB/39sf8A5Jo/4SnVP+hH8Qf9/bH/AOSaAOkorm/+Ep1T/oR/EH/f2x/+SaP+Ep1T/oR/EH/f2x/+SaAOkorm/wDhKdU/6EfxB/39sf8A5Jo/4SnVP+hH8Qf9/bH/AOSaADQP+R08V/8AXe2/9J1rpK5nwtHqEuta/qWoaVdaWl7PCYYrp4mchIlUn927gcg966agAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigD//Z)Pour récupérer les données d’un capteur, il faut d’abord le brancher le capteur à l’alimentation externe et à l’adaptateur 4-20 mA. Le branchement change en fonction du nombre de câbles sur le capteur, ici, on a 2 câbles.

Alimentation (24V)

Capteur

Adaptateur 4-20 mA

Ce qui nous donne, une fois monter :

Câblage de la boucle 4-20mA

Une image contenant table

Description générée avec un niveau de confiance très élevé

Pour récupérer l’ensemble des données, nous avons utilisé la librairie fournie par le vendeur, et donc avons monté le programme en utilisant celle-ci.

Cette librairie nous permet de retourner 4 valeurs :

* readChannel ( lecture d’un canal )
* readVoltage ( lecture du voltage )
* readCurrent ( lecture du voltage d’un canal )
* isConnected ( savoir si un canal est connecté )

Ainsi, pour récupérer les valeurs du capteur de température de l’air, qui se trouve sur le canal 3, et qui fonctionne de 0°C à 45°C, on procède de cette façon :

if (sensorBoard.isConnected(CHANNEL3))

Cette ligne sert à savoir si un capteur est bien relié au canal 3

current = sensorBoard.readCurrent(CHANNEL3);

Cette ligne sert à affecter la valeur du voltage au **float** current.

valeur = ((current-4)\*45)/16;

Cette ligne sert à affecter la valeur de la température au **float** valeur.

-4 correspond à la boucle 4-20mA, qui correspond à une boucle 0-16mA, qui facilite les calculs. Le 16 au maximum.

45 correspond à la valeur maximale que le capteur peut capter.

# Mise en place de l’application Web

## Conception de la charte graphique

Pour la conception de la charte graphique de l’application Web, nous nous sommes inspirés du site Web qu’ils utilisent actuellement. Ainsi, avec le site Canva, nous avons préparer les pages du site à l’avance pour savoir comment réaliser le CSS du site, ainsi que le HTML.

Canva est un site pour créer facilement des designs, ici, il nous sert à présenter nos pages Web, ainsi, nous avons réalisé :

![Une image contenant capture d’écran

Description générée avec un niveau de confiance élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzc4AACSkgACAAAAAzc4AADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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Cette page est la page d’accueil du site, nous pouvons grâce à la barre de navigation naviguer sur les différentes pages.

Nous pouvons aussi y accéder en cliquant sur les icones que nous pouvons voir ici sous le titre « Fonctionnalités ».

![Une image contenant texte

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élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzg1AACSkgACAAAAAzg1AADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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Cette page est la page qui concerne la partie application Web de Samuel, l’étudiant 3. On y voit une serre en fond d’écran, où les dernières données des capteurs seront affichées dynamiquement.

![Une image contenant capture d’écran

Description générée avec un niveau de confiance très élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzYxAACSkgACAAAAAzYxAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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CiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAK82+Df/ADPv/Y56j/7Tr0mvNvg3/wAz7/2Oeo/+06AD4N/8z7/2Oeo/+069Jrzb4N/8z7/2Oeo/+069JoAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAKKKKACiiigAooooAK82+Df/M+/wDY56j/AO069Jrzb4N/8z7/ANjnqP8A7ToA8gtfiR4h8H+LPGen6LJbLBJ4mvp2EsO87i+0859FFX/+F5+NP+e1j/4Cj/GuF17/AJKB4v8A+xgvf/RpqpUlI9F/4Xn40/57WP8A4Cj/ABo/4Xn40/57WP8A4Cj/ABrzqigdj0X/AIXn40/57WP/AICj/Gj/AIXn40/57WP/AICj/GvOqKAsei/8Lz8af89rH/wFH+NH/C8/Gn/Pax/8BR/jXnVFAWPRf+F5+NP+e1j/AOAo/wAaP+F5+NMZ86xx/wBev/1686q1Bqd3bQiKCUKgJIBRT1+ooCx3Y+OfjU9JrI/S1/8Ar0f8Lz8af89rH/wF/wDr1xJ1zUPMDrOqsBgbY1H9PamyaveypsklDLnPMa9fy9qAO4/4Xn40AyZrLH/Xr/8AXo/4Xn40xnzrLHr9l/8Ar1xI1vUApXz12li2PKXGT17e1Kdd1EqFNwMDt5a/4UBY7X/henjT/ntY/wDgKP8AGj/hefjUDJmssf8AXr/9euFXVLtIljSVVReFUIvHOfSnprV+iFRONpYtgxqeT17UAdv/AML08aYz51jj1+y//Xo/4Xp40HWax/8AAX/69cQus36lsTj5juP7teuMentSSaxfSxNHJMpVxhv3ajI/KgLHcf8AC8/Gn/Pex/8AAUf40f8AC8/Gn/Pax/8AAUf4151RQFj0X/hefjT/AJ7WP/gKP8aP+F5+NP8AntY/+Ao/xrzqigLHov8AwvPxp/z2sf8AwFH+NH/C8/Gn/Pax/wDAUf4151RQFj0X/hefjT/ntY/+Ao/xo/4Xn40/57WP/gKP8a86ooCx6L/wvPxp/wA9rH/wFH+NH/C8/Gn/AD3sf/AUf4151QaAsei/8L08Z/8APex/8BR/jR/wvPxp/wA9rH/wF/8Ar1xH9sXm/duizjGfJT/Cqk0z3EzSykF26kDFAWPQv+F5+NMZ86yx6/Zf/r0f8L08af8APex/8Bf/AK9cNBq19bWq28M+2FWLBCinBP1FK2sXzKVaZSD/ANM1/wAKAO4/4Xp40/57WP8A4C//AF6P+F5+NP8AnvY/+Ao/xri217UWxmZBjuIl5+vFZ2ckk96Asei/8Lz8af8APax/8BR/jR/wvPxp/wA9rH/wFH+NedUUBY9F/wCF5+NP+e1j/wCAo/xo/wCF5+NP+e1j/wCAo/xrzqigLHov/C8/Gn/Pax/8BR/jR/wvPxp/z2sf/AUf4151RQFj0X/hefjT/ntY/wDgKP8AGj/hefjT/ntY/wDgKP8AGvOqKAsei/8AC8/Gn/Pax/8AAUf40f8AC8/Gn/Pax/8AAUf4151RQFj0X/hefjT/AJ7WP/gKP8a739na+m1Twn4m1C7Kme78TXU8pUYBZkiY4Hbk18+171+zL/yT/XP+xguP/RUNNCZ414q8LeLF8f8AiiW38JeILiC41m7mimg02VkkRpWwwIGCCOcisz/hGvGH/Ql+J/8AwVTf4UUUxXD/AIRrxh/0Jfif/wAFU3+FH/CNeMP+hL8T/wDgqm/woooC4f8ACNeMP+hL8T/+Cqb/AAo/4Rrxh/0Jfif/AMFU3+FFFAXD/hGvGH/Ql+J//BVN/hR/wjXjD/oS/E//AIKpv8KKKAuH/CNeMP8AoS/E/wD4Kpv8KP8AhGvGH/Ql+J//AAVTf4UUUBcP+Ea8Yf8AQl+J/wDwVTf4Uf8ACNeMP+hL8T/+Cqb/AAoooC4f8I14w/6EvxP/AOCqb/Cj/hGvGH/Ql+J//BVN/hRRQFw/4Rrxh/0Jfif/AMFU3+FH/CNeMP8AoS/E/wD4Kpv8KKKAuH/CNeMP+hL8T/8Agqm/wo/4Rrxh/wBCX4n/APBVN/hRRQFx8PhzxWsymfwR4peP+JV0yZSfx21aTw5rny+Z4H8ZH+9jTpP0+SiigLlSXw34sMreT4K8UrHn5Q+mSkgfXbTf+Ea8Yf8AQl+J/wDwVTf4UUUBcP8AhGvGH/Ql+J//AAVTf4Uf8I14w/6EvxP/AOCqb/CiigLh/wAI14w/6EvxP/4Kpv8ACj/hGvGH/Ql+J/8AwVTf4UUUBcP+Ea8Yf9CX4n/8FU3+FH/CNeMP+hL8T/8Agqm/woooC4f8I14w/wChL8T/APgqm/wo/wCEa8Yf9CX4n/8ABVN/hRRQFw/4Rrxh/wBCX4n/APBVN/hR/wAI14w/6EvxP/4Kpv8ACiigLh/wjXjD/oS/E/8A4Kpv8KP+Ea8Yf9CX4n/8FU3+FFFAXD/hGvGH/Ql+J/8AwVTf4Uf8I14w/wChL8T/APgqm/woooC4f8I14w/6EvxP/wCCqb/Cj/hGvGH/AEJfif8A8FU3+FFFAXD/AIRrxh/0Jfif/wAFU3+FH/CNeMP+hL8T/wDgqm/woooC4f8ACNeMP+hL8T/+Cqb/AAo/4Rrxh/0Jfif/AMFU3+FFFAXD/hGvGH/Ql+J//BVN/hR/wjXjD/oS/E//AIKpv8KKKAuH/CNeMP8AoS/E/wD4Kpv8K+gf2ctJ1TR/AGqxa1pl7ps82szTJDe27QuUMUWGwwBxkEZ9jRRQFz//2Q==)

Cette page est la page qui concerne ma partie de l’application Web. On pourra ainsi voir les données d’un capteur sur une période définie.

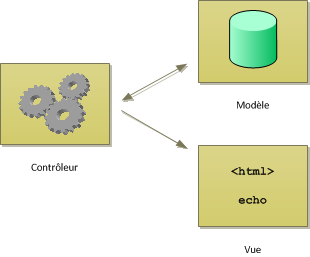
Ainsi on voit deux calendriers qui serviront à choisir la période, ainsi que la courbe.

## Architecture de l’application

Pour l’architecture de l’application, il a été demandé de suivre le modèle Modèle-Vue-Contrôleur. Ce pattern sert à bien organiser son code. Ainsi, il permet de diviser son code en trois grandes parties :

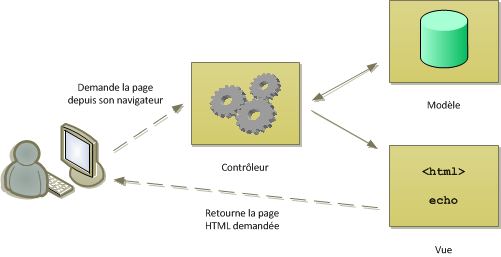
* **Modèle** : Cette partie gère les données du site. C’est entre autres elle qui va chercher les informations brutes dans la base de données, donc ce sont des requêtes SQL.
* **Vue**: Cette partie se concentre sur l’affichage. Elle se contente de récupérer les variables, et comporte essentiellement du code PHP, et HTML. Dans notre projet, il s’agira d’un script.
* **Contrôleur**: Cette partie gère la logique du code qui prend des décisions. C’est lui qui fait le lien entre le modèle et la vue. Donc il va demander les données au modèles les données, les analyser et ensuite envoyer le texte à afficher à la vue.

Echange d'informations entre les éléments



Concrètement, le visiteur demandera la page au contrôleur et c’est la vue qui lui sera retournée.

La requête du client au contrôleur qui affiche la vue



Dans le projet, nous auront ainsi trois pages dans ma partie :

* Evolution\_mesure.php (le contrôleur)
* Graphique\_mesure.js (la vue)
* Recuperer\_donnees.php (le modèle)

## Connexion à la base de données

La connexion à la base de données s’effectue dans une page situer dans un dossier inc. Il est nommé connect.php. Notre base de données étant sur un serveur distant, il doit être renseigner l’adresse de celui-ci, et beaucoup d’autres données. Ce qui nous donne :

$db = null;

On indique le moteur de la base de données

$db\_engine = 'mysql';

$host = '92.222.92.147';

Adresse de la base de données

$charset = 'utf8';

$db\_user = 'projetbts';

Information concernant la table, le mot de passe et la base de données

$db\_password = 'Nantes44';

$db\_base = 'supervision\_serre';

Après avoir renseigné tous ce qu’il nous faut comme informations pour la connexion, on essaye de se connecter à la base de données :

try{

$dsn prend en paramètre les informations

$dsn = "mysql:host=$host;dbname=$db\_base;charset=$charset";

$options = [

PDO::ATTR\_ERRMODE => PDO::ERRMODE\_EXCEPTION,

PDO = PHP Data Objects

PDO::ATTR\_DEFAULT\_FETCH\_MODE => PDO::FETCH\_OBJ,

PDO::ATTR\_EMULATE\_PREPARES => true,

];

On créer la connexion avec les paramètres

$bdd = new PDO($dsn, $db\_user, $db\_password, $options);

}

Ensuite, si la connexion échoue, l’utilisateur doit être avertie par un message d’erreur :

catch (PDOException $e){

print(json\_encode(array('outcome' => false, 'message' => 'Impossible de se connecter !')));

}

Ici, si la connexion à la base de données n’est pas possible, il y aura un message d’erreur qui s’affichera sur les pages possédant une connexion à la base de données.

## Gestion de la période

Pour afficher le graphique, dans un premier temps, l’utilisateur doit choisir une période, ainsi dans la page evolution\_mesure.php, deux input de type=’date’ sont présent sur la page.

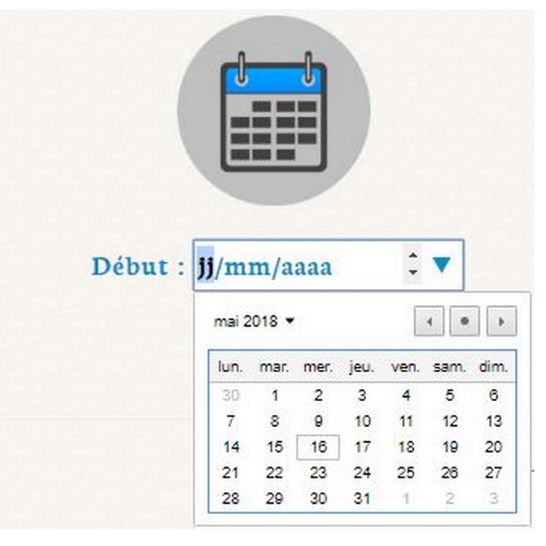
![Une image contenant capture d’écran

Description générée avec un niveau de confiance très élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzcwAACSkgACAAAAAzcwAADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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<input type="date" name="date\_1" style="text-align: center">

L’élément <input> de type date permet de créer un champ pour la saisie d’une date. Elle est composée d’une année, d’un mois et d’un jour.

Ainsi, après avoir effectué un clic sur l’input, on aura un affichage beaucoup plus aisé pour choisir les dates :



En cliquant sur une date, la date s’auto inscrit dans l’input.

Le name=’date\_1’ sera ensuite utiliser pour le code PHP, c’est ce qui va pouvoir modifier les deux valeurs rentrées dans les input.

Pour ensuite envoyer les informations, on utilisera un bouton de validation, et un formulaire.

<form method="get">

<button type="submit" value="submit" class="btn btn-primary">Valider</button>

Ici le formulaire a pour méthode get, c’est-à-dire que les valeurs des deux dates seront envoyées directement dans l’URL. Nous aurons ainsi :

evolution\_mesure.php?date\_1=2018-05-03&date\_2=2018-05-18

Bien évidemment les dates auparavant choisie doivent être le 3 Mai 2018 et le 18 Mai 2018.

Il faut ensuite pouvoir gérer les différentes erreurs, comme le fait de choisir une date de fin plus récente que la date de début. Pour montrer cette erreur au superviseur, j’ai choisi d’afficher un message d’erreur directement sur la page.

$date\_debut = $\_GET['date\_1'];

$date\_fin = $\_GET['date\_2'];

if ($date\_fin < $date\_debut) {

echo '<h1 style="color: red;">Les dates sont erronées.</h1>';

}

Le script ici récupère les valeurs dans l’URL, et si la date de fin est plus récente que la date du début, le superviseur sera ainsi informé par un message que les dates qu’il a sélectionné sont erronées. Le graphique ne sera pas affiché sur le message d’erreur apparait.

## Affichage d’un graphique

### 5.5.1) Requêtes pour récupérer les données du graphique

La partie affichage d’un graphique correspond à la Vue du modèle MVC. Quant au PHP pour récupérer les données, il s’agit du modèle.

Pour afficher le graphique, il faut pouvoir récupérer 3 valeurs distinctes. Le nom du capteur, la période choisie par le superviseur ainsi que les valeurs du capteur capturés durant la période.

![Une image contenant capture d’écran

Description générée avec un niveau de confiance très élevé](data:image/jpeg;base64,/9j/4AAQSkZJRgABAQEAYABgAAD/4RDyRXhpZgAATU0AKgAAAAgABAE7AAIAAAANAAAISodpAAQAAAABAAAIWJydAAEAAAAaAAAQ0OocAAcAAAgMAAAAPgAAAAAc6gAAAAgAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAFdpbGx5IFJJTkVBVQAAAAWQAwACAAAAFAAAEKaQBAACAAAAFAAAELqSkQACAAAAAzg5AACSkgACAAAAAzg5AADqHAAHAAAIDAAACJoAAAAAHOoAAAAIAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAAA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peut ainsi repérer les requêtes à faire une à une sur le diagramme de séquence du système.

Le graphique devra afficher la période

Le graphique afficher le nom du capteur

Pour récupérer le nom du capteur, nous utiliserons une variable :

* $nom\_capteur = $\_GET['choix\_capteur'];

La valeur du $nom\_capteur prendra en paramètre le choix d’un select qui comportera tous les noms des capteurs.

Pour récupérer les dates, nous utiliserons simplement les variables :

* $date\_debut = $\_GET['date\_1'];
* $date\_fin = $\_GET['date\_2'];

La méthode GET est utilisée ici car les valeurs des dates sont placées dans l’URL de la page Internet.

Pour récupérer les valeurs de chaque capteur dans l’intervalle donné, il faudra utiliser les deux paramètres ci-dessus :

* function getIDOfSensor($dbh)

{

$request = $dbh->prepare( 'SELECT id FROM materiel WHERE nom = $nom\_capteur' );

return $request->execute() ? $request->fetchAll() : null;

}

$sensor = getIDOfSensor($bdd);

Cette fonction permet de récupérer l’ID grâce au nom du capteur. Et on affecte cet ID à la variable $sensor.

* function getFullOfValues($dba)

{

$request = $dba->prepare('SELECT valeur FROM releve WHERE id\_materiel = $sensor' AND WHERE valeur BETWEEN $date\_debut AND $date\_fin);

return $request->execute() ? $request->fetchAll() : null;

Cette fonction quant à elle permet de récupérer toutes les valeurs correspondantes à l’ID du capteur choisi, se situant entre la période choisie.

### 5.5.2) Insérer des données au graphique

Pour pouvoir insérer les valeurs PHP dans le tableau, il faut encoder les tableaux du script en JSON pour que Javascript puisse les lire. Ainsi, on utilise la fonction json\_encode.

Ainsi, pour reprendre l’exemple du tableau de valeur ci-dessus, on écrit :

$series = [

'name' => [$sensors],

'type' => ['line'],

'data' => [$releves]

];

Name, type et data sont les paramètres pour définir le graphique en javascript. On leur infecte ainsi les valeurs reçues par le code PHP. C’est alors ici que la fonction va servir, car le Javascript ici ne peut lire que des données extraites au format JSON.

json\_encode($series);

### 5.5.3) Création d’une page pour ajouter un capteur

Pour pallier la contrainte d’évolutivité, il a été décidé avec Samuel d’ajouter un page pour créer un capteur, et l’ajouter directement à la base de données. Ainsi, grâce au site Web, le superviseur pourra ajouter le capteur avec les données qu’il souhaite, ainsi, via cette page, il pourra ainsi ajouter :

* Le nom du capteur
* Son abréviation
* L’unité du matériel
* Le type du matériel

Ainsi, la page ressemblera à :



Le bouton sudmit qui exécutera les requêtes

Un select pour sélectionner l’unité

Un input de type texte pour récupérer le nom

Lors du clic sur le bouton Ajouter, de nombreux INSERT se feront dans la base de données. Par exemple, pour ajouter le nom du capteur, on aura :

$nom\_capteur = $\_POST[‘nom\_capteur’];

INSERT INTO materiel (nom) VALUES ($nom\_capteur)

# Tests unitaires

## Test unitaire de la méthode loop()

## Test unitaire de la gestion de la période

# Conclusion

# Annexes