BLOOD DRAIN MONITORING SYSTEM

TEAM-5:

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ABSTRACT

Project focuses on blood drain monitoring system in drain sites for detection of blood accumulation. We plan to achieve this using spectroscopy.

PROBLEM

Post surgery drain sites are not monitored properly leading to the delay in the healing process. We plan to do a drain monitoring system which detects blood accumulation in the surgical sites.

WHAT HAS BEEN DONE SO FAR?

- Selection of sensor and integrating it with the microcontroller
- Creation of a synthetic dataset
- Model-training for classification

HARDWARE AND SOFTWARE COMPONENTS USED

- **HARDWARE:**

  AS72653- spectrometer

  Arduino Uno Microcontroller

- **SOFTWARE:**

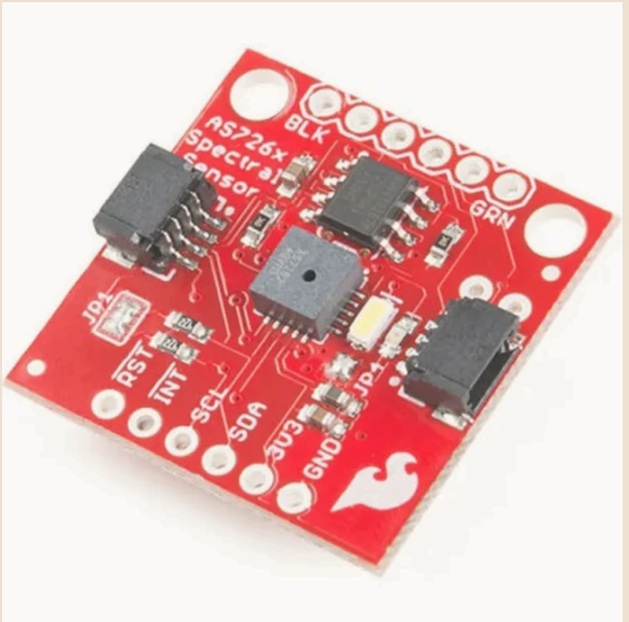
  Python: for model training

  MatLab: for creation of synthetic dataset

HARDWARE IMPLEMENTATION

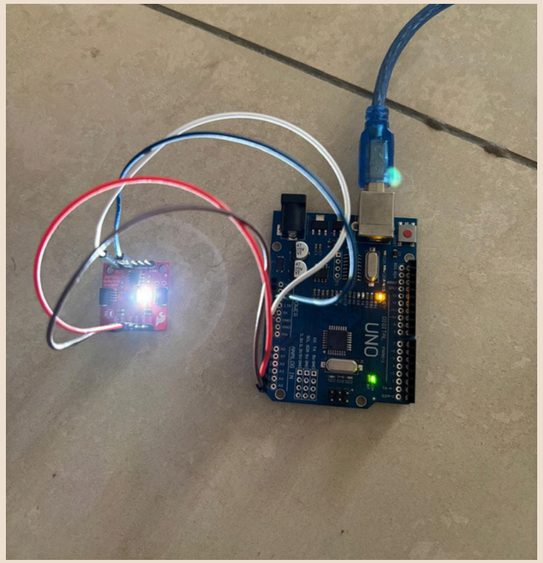
Working principle of the spectrometer:

- Light interaction with the sample
- The light is absorbed or reflected based on the sample's properties.
- AS72653 spectrometer captures the light intensity across six channels which corresponds to specific wavelengths
- (Violet, Blue, Green, Yellow, Orange, and Red.)



HARDWARE IMPLEMENTATION

Circuit connections:



SCL	A5
SDA	A4
3V3	3.3v
Gnd	Gnd

Range for creating the synthetic dataset

"Low Blood Accumulation" If Red < 4500 & Green < 2700

"Moderate Blood Accumulation" If Red is between 4500-4800 & Green 2700-3000

"High Blood Accumulation" If Red > 4800 & Green > 3000

Dataset

A	B	C	D	E	F	G
Violet	Blue	Green	Yellow	Orange	Red	Label
623.2255	660.9748	2766.698	4157.942	4598.53	4958.327	1
691.5014	614.9775	2586.928	4089.565	4447.711	4935.42	0
604.7534	699.1915	2562.029	4082.209	4473.815	5002.416	0
602.7993	560.0263	2778.119	3926.332	4466.199	4868.327	1
624.6642	631.4349	2734.26	4056.565	4765.975	4602.978	0

Semi-supervised learning

700 unlabeled and 300 labeled

95	628.2843	638.4357	2551.614	3951.029	4638.171	4898.716	-1
96	655.1671	695.1161	2688.527	3997.365	4560.508	5105.456	-1
97	699.4108	675.7732	2604.219	4124.823	4769.706	4967.657	-1
98	648.1203	592.9245	2678.547	4000.922	4779.775	4809.453	-1
99	696.1996	651.4575	2711.823	4187.308	4769.938	5083.63	-1
00	615.5241	674.5648	2639.242	3989.607	4561.653	5082.141	-1
01	653.9132	588.9748	2606.212	3956.021	4475.328	4632.803	-1
02	683.5691	607.6226	2502.85	3992.707	4718.374	4696.936	-1
03	678.1343	629.7271	2546.174	4057.576	4441.62	5000.406	-1

The -1 in the above picture represents the unlabeled datapoints

```
Iteration 1: Added 1 pseudo-labeled samples.
No more confident samples, stopping self-training.

Final Model Accuracy: 0.765

Classification Report:
              precision    recall  f1-score   support

          -1       0.77      0.94      0.85       701
           0       0.75      0.33      0.46       238
           1       0.64      0.41      0.50        61

    accuracy                           0.77      1000
   macro avg       0.72      0.56      0.60      1000
weighted avg       0.76      0.77      0.74      1000
```

Semi-supervised learning

400 labelled and 600 unlabelled

```
Iteration 1: Added 613 pseudo-labeled samples.
Iteration 2: Added 0 pseudo-labeled samples.

Final Model Accuracy: 0.974

Classification Report:
              precision    recall  f1-score   support

           0       0.97      1.00      0.98        61
           1       1.00      0.88      0.94        17

    accuracy                           0.97        78
   macro avg       0.98      0.94      0.96        78
weighted avg       0.98      0.97      0.97        78
```

Semi-supervised learning

400 labelled and 600 unlabelled

```
Iteration 1: Added 431 pseudo-labeled samples.
Iteration 2: Added 69 pseudo-labeled samples.
Iteration 3: Added 15 pseudo-labeled samples.
Iteration 4: Added 5 pseudo-labeled samples.
Iteration 5: Added 8 pseudo-labeled samples.
```

```
Iteration 1: Added 613 pseudo-labeled samples.
Iteration 2: Added 0 pseudo-labeled samples.

Final Model Accuracy: 0.974

Classification Report:
              precision    recall  f1-score   support

           0       0.97      1.00      0.98        61
           1       1.00      0.88      0.94        17

    accuracy                           0.97        78
   macro avg       0.98      0.94      0.96        78
weighted avg       0.98      0.97      0.97        78


Enter spectral values separated by commas (or type 'exit' to quit):  606,567,2770,3920,4466,4855
Prediction: Blood Present
```

PROBLEMS THAT WE FACED

1. **Selection of sensor**
2. **Selection of model of the sensor**
3. **Acquiring real time dataset**

FUTURE WORK

- Taking real- time dataset
- Integrating with AS7265x chipset
- Building more efficient model

THANK YOU!