

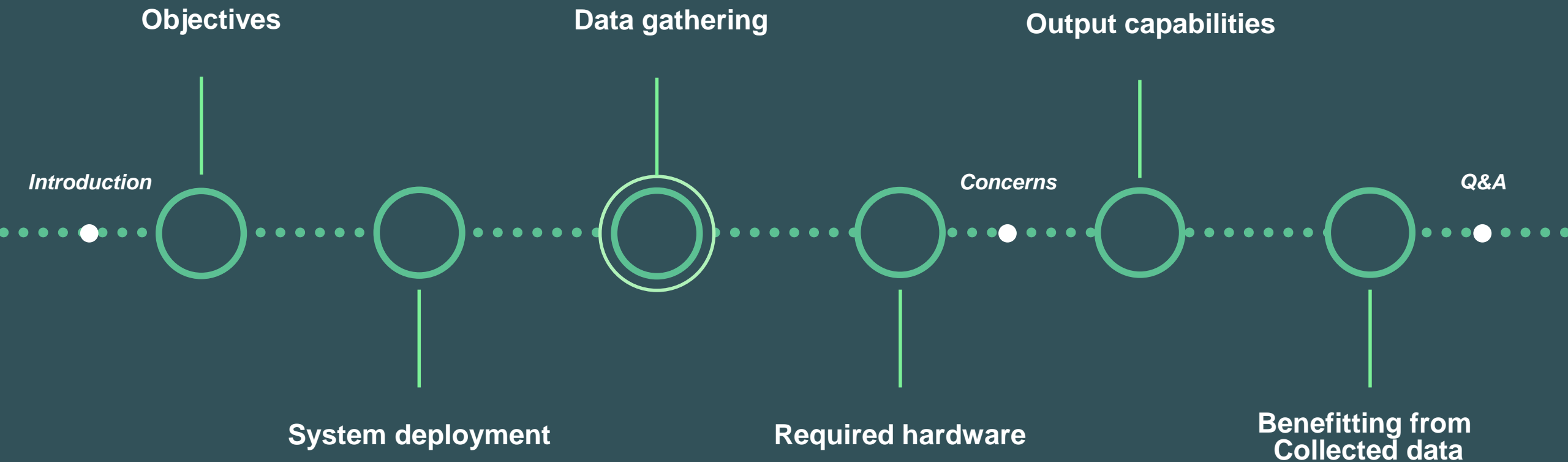
UBIQUITOUS COMPUTING

COURSEWORK I

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INTRODUCTION



How can we create

Interactive plant pots

Using measurable information





Do plants produce distinct electrical activity?



Can we measure that?



Every plant contains a bioelectrical activity directly influenced by the environment and their species. It plays an important part in a plant's physiological activities and is referred to by some scientists as the “main transmission route in the stems of higher plants” [1]

OBJECTIVES

1

Determine if it is possible to collect electrical signals from higher plants using tools available to us.

2

Create synthesized sound and LED output patterns using gathered data to represent the dynamic bioelectrical activity of a plant.



SYSTEM DEPLOYMENT

Where will it be deployed?

The objective of this project is to enhance the Lion's Gate Garden initiative. The system will be deployed on one of the higher plants in the greenhouse with the possibility of expansion based on the project's success.

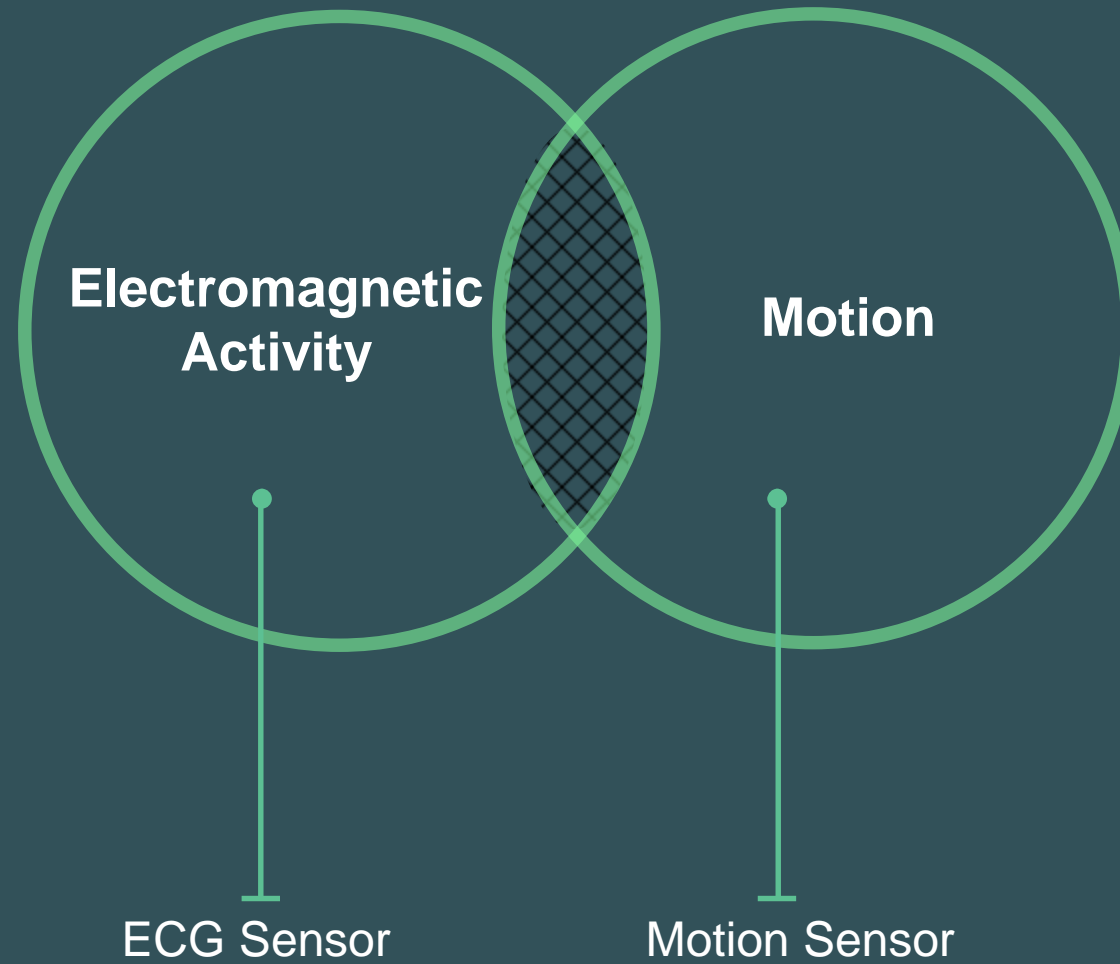
DATA GATHERING & RESEARCH

Our research provides evidence of direct correlation between electrical behaviour with its species and the environment.

DATA GATHERING



GATHERING DATA What will we sense?



WHAT WILL WE SENSE?

By combining an electromagnetic sensor and an ECG module, we want to record the action potential in a higher plant.

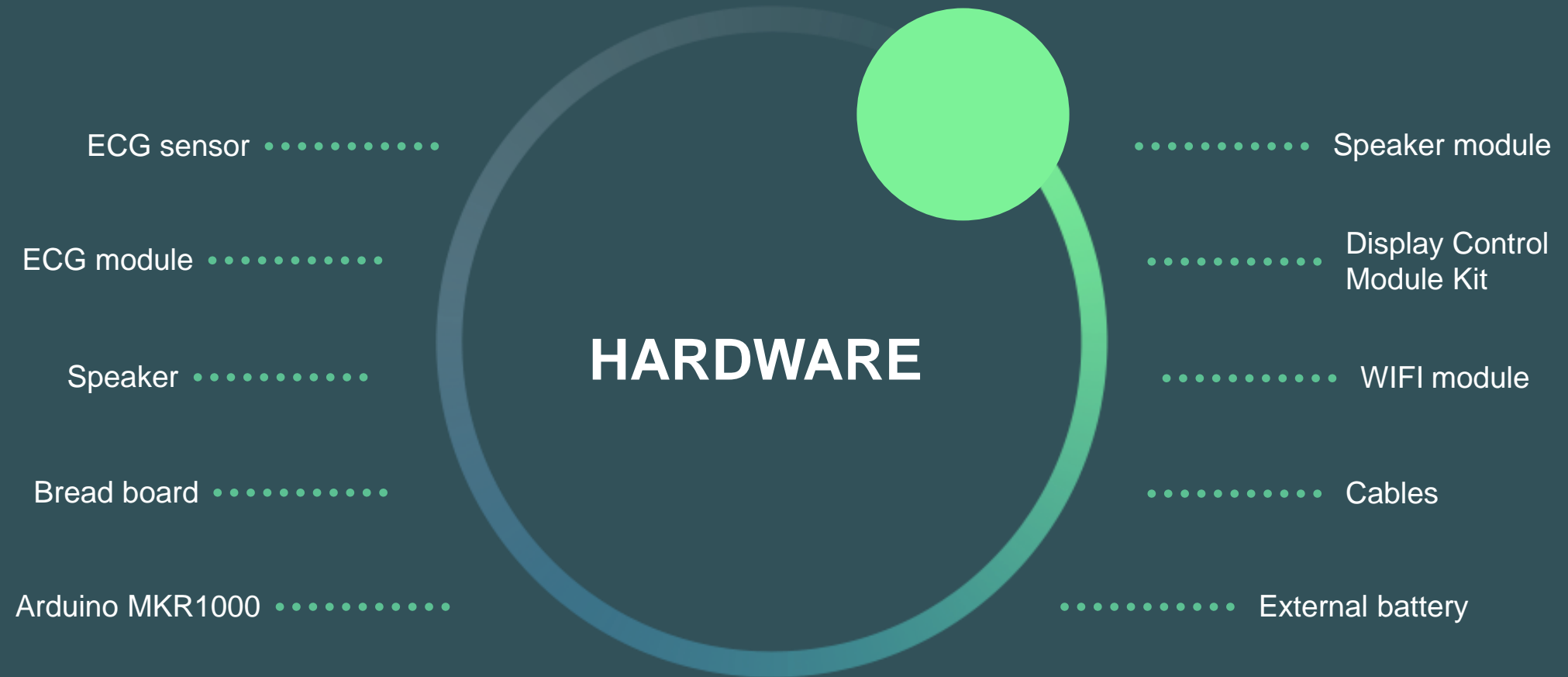
This approach is referred to as extracellular technique which focuses on non-invasive data gathering. We want to enhance the system by sensing motion around the plant and function as a trigger for the output.

The goal is to create a “personality” for each plant in the greenhouse. This will be determined by the gathered electrical activity.

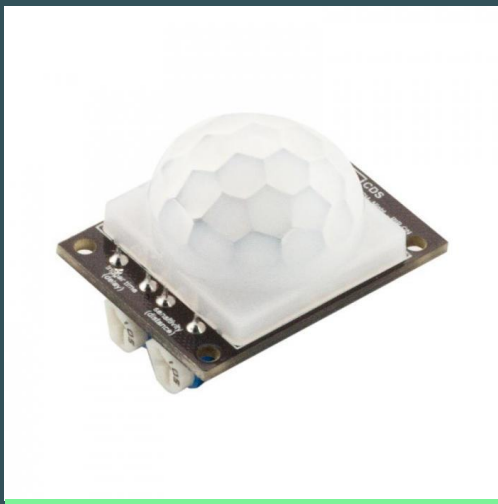
HOW OFTEN WILL IT RECORD THE DATA?

Motion sensor will detect when someone passes by and a demo will be activated for couple of seconds. The motion sensor detection interval will be restricted based on the duration of the demo.

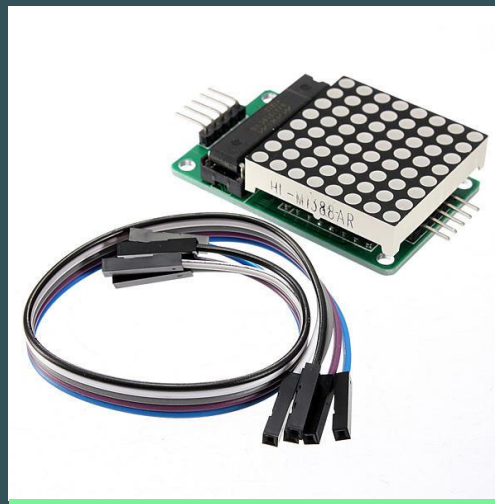
Detecting motion will turn on the ECG sensor that will record and send the data every few seconds for the whole duration of the demo.



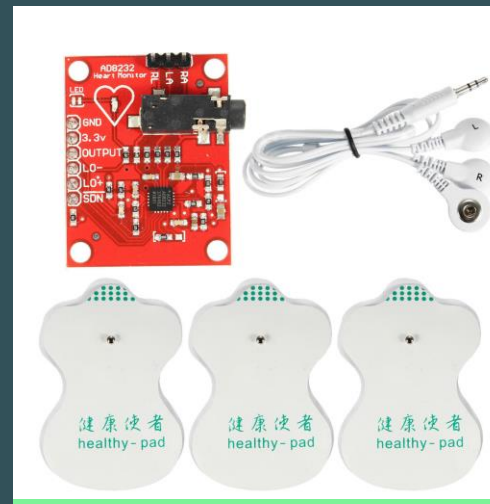
HARDWARE



PIR Motion Sensor



Dot Matrix MCU LED
Display Control
Module Kit

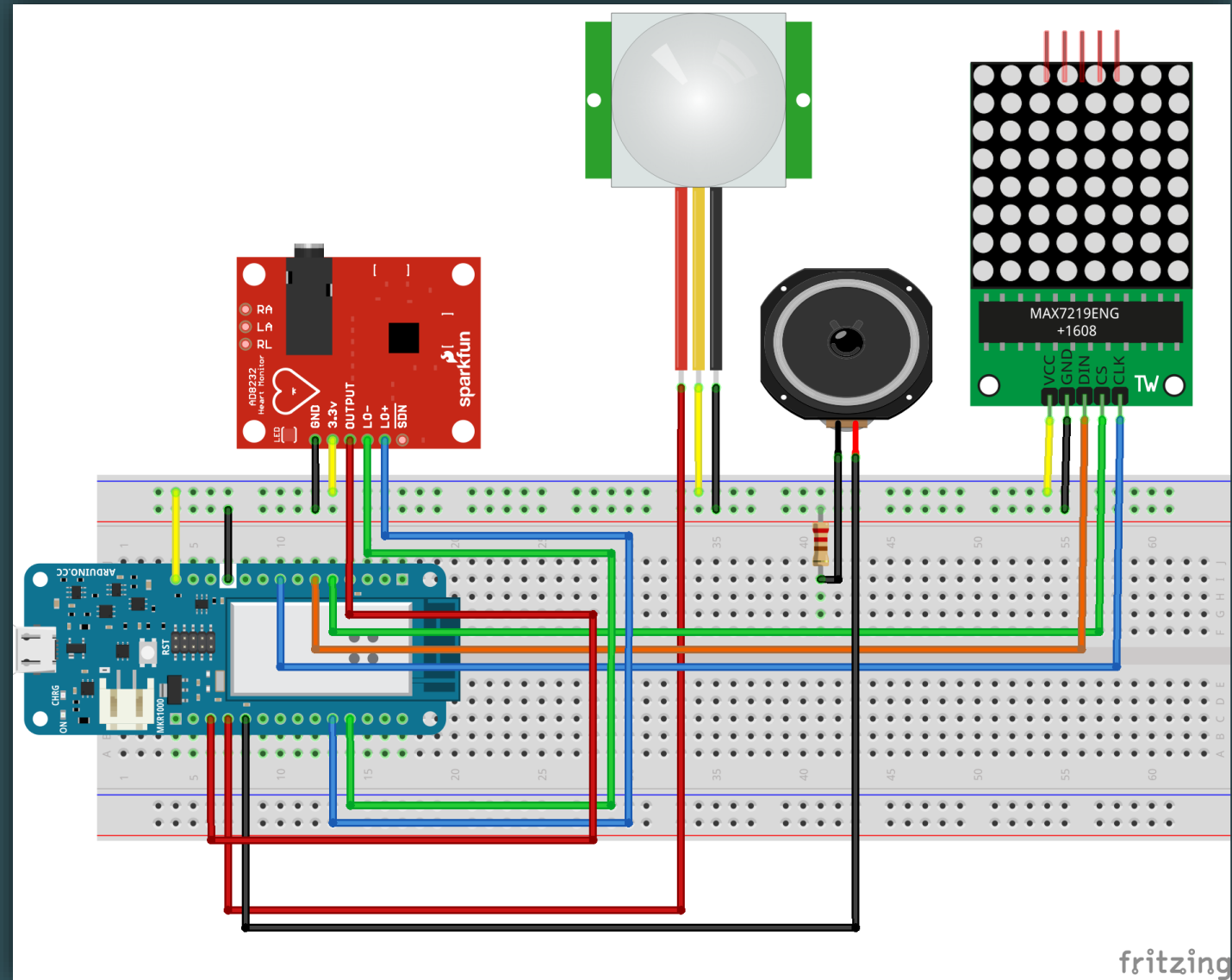


ECG Measurement
Module Kit



Speaker Module with
Power Amplifier

HARDWARE



It is just a project idea and we want to focus mainly on functionality, so we do not plan on exploring details such as water resistance, cost efficiencies for production or reusable source of energy.

WHAT LIBRARIES WILL WE USE?

1. PIR Motion Sensor
2. ECG
3. LED
4. Audio & tone()

A graphic on a dark teal background. It features a large, light gray circle with a thick teal border. A smaller, solid lime green circle is positioned at the top-left edge of the larger circle. The word "CONCERNS" is written in a bold, dark gray, sans-serif font in the center of the large circle.

CONCERNS

HOW WILL IT BE POWERED?

The system will have an external source of power, most likely a battery that can support the estimated power consumption.

WILL IT CONNECT TO THE INTERNET?

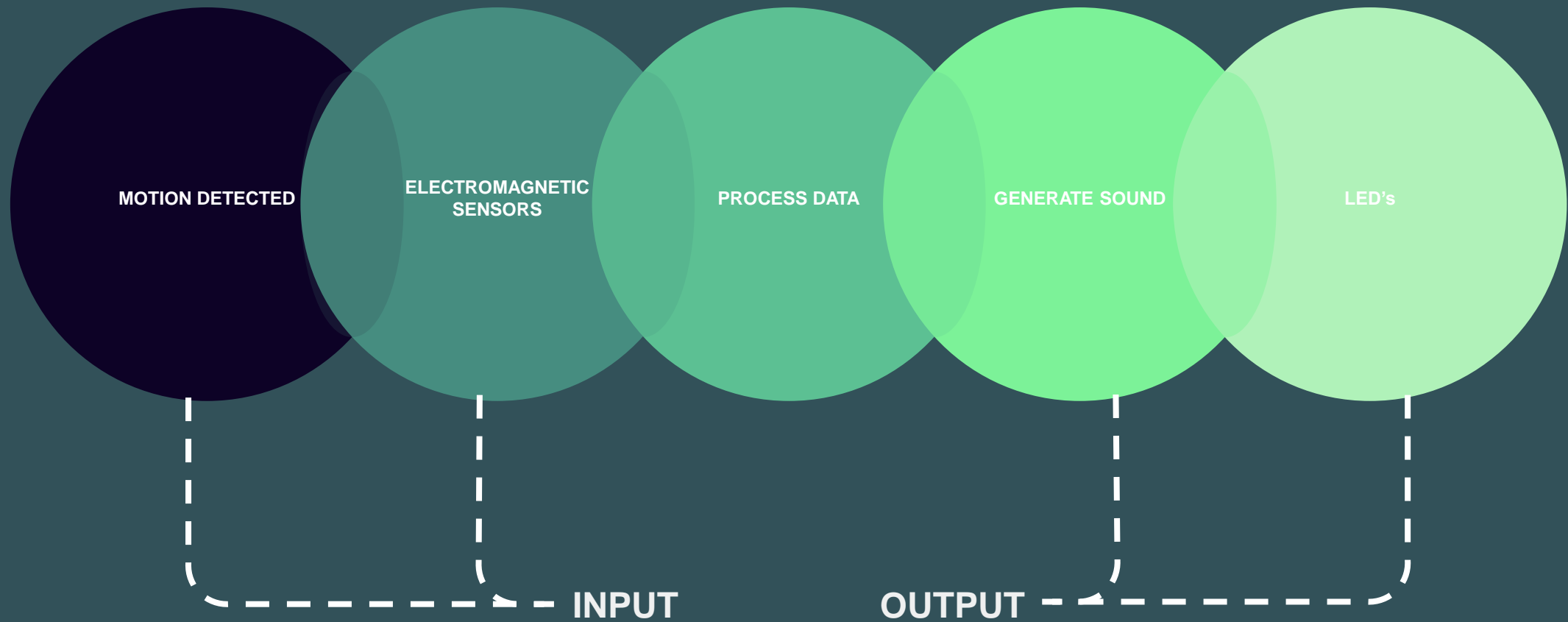
It will connect to the internet and send the data to be illustrated or even be used as a source for an API. We will be using a WIFI module to support WPA2 Enterprise encryption

WHAT IS THE IMPACT ON THE BATTERY?


The actual duration of the demo will be investigated and determined based on the battery consumption. From our assumptions and calculations, it should be around 15s – 30s of play time.

The motion sensor won't try to detect anything until the initiated demo is finished. The fact that our data will be recorded after detecting a motion will help with the battery consumption issues.

DEMO



The bioelectrical activity will be illustrated by LED's and custom sounds. Their behaviour will be determined by different frequencies gathered live from the electromagnetic sensor.



**Who can benefit
from the data
collected?**

We believe that the gathered data would help in creating a unique atmosphere in the greenhouse and it would go well with projects like the interactive chair and other future additions to the initiative.



PROJECT TIMESCALE

PROJECT TIMESCALE

24
SEP

Starting the group project

14
OCT

COURSEWORK I
Project proposal

10
NOV

Getting hardware components

9
DEC

Coursework II



QUESTIONS



THANK YOU

References



- PIR Motion Detector: <https://www.instructables.com/id/PIR-Motion-Detector-With-Arduino-Operated-at-Lowes/>
- Electrical experiments with plants that count and communicate: <https://www.youtube.com/watch?v=pvBISFVmoaw>
- Arduino for an Easy Way to Make Noise: <https://programmingelectronics.com/an-easy-way-to-make-noise-with-arduino-using-tone/>
- Arduino WiFi Pulse Monitor: <https://create.arduino.cc/projecthub/andres-santos/arduino-wifi-pulse-monitor-9da806>
- Generating tones: https://www.hackster.io/Jalal_Mansoori/generating-tones-of-different-frequencies-using-mathematics-f3ec47
- Electrical signals in higher plants: http://www.linv.org/images/papers_pdf/trends%20plant%20sci%202006%20brenner.pdf

SLIDE NOTES

Slide Nr 5:

Higher plants = plants of relatively complex or advanced characteristics, especially vascular plants (including flowering plants).

[1] : <https://www.nature.com/articles/srep13425>

Slide Nr 9:

Image reference: [https://images.squarespace-cdn.com/content/v1/54018783e4b071fa0604bcf6/1461056717827-](https://images.squarespace-cdn.com/content/v1/54018783e4b071fa0604bcf6/1461056717827-DWS8CW9T5ATMRONEX4KL/ke17ZwdGBToddI8pDm48kJIAGv-o_Z732ce1152ipl97gQa3H78H3Y0txjaiv_0fge73oT595KOVb1pRuvXoaBWIfjrKre2ccubEWtUoGLKPD-DQ-ufdXsosQdbHrsF2eoqS5JAWrnb1436X_b_yVU9kZPbuygN4RSDPe_G5PO_UdftYbqF7AeyxxVeiX3GnSOXuNcbJZWOpLlgwg9WURg/DSCF1344.JPG?format=2500w)

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[JPG?format=2500w](https://images.squarespace-cdn.com/content/v1/54018783e4b071fa0604bcf6/1461056717827-DWS8CW9T5ATMRONEX4KL/ke17ZwdGBToddI8pDm48kJIAGv-o_Z732ce1152ipl97gQa3H78H3Y0txjaiv_0fge73oT595KOVb1pRuvXoaBWIfjrKre2ccubEWtUoGLKPD-DQ-ufdXsosQdbHrsF2eoqS5JAWrnb1436X_b_yVU9kZPbuygN4RSDPe_G5PO_UdftYbqF7AeyxxVeiX3GnSOXuNcbJZWOpLlgwg9WURg/DSCF1344.JPG?format=2500w)

Slide Nr. 17:

1. Motion Sensor: <https://learn.adafruit.com/pir-passive-infrared-proximity-motion-sensor>

2. ECG Library:

https://github.com/sparkfun/AD8232_Heart_Rate_Monitor/blob/master/Software/Heart_Rate_Display_Arduino/Heart_Rate_Display_Arduino.ino

3. LED: <https://github.com/nickgammon/MAX7219>

4. Audio tone(): <https://www.arduino.cc/reference/en/language/functions/advanced-io/tone/>