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Methodology for *Integrated Mapping of Radiation and Light Intensity* in Power Transmission Lines

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UV-B Radiation (280–320 nm)

- A biologically active part of sunlight.
- **Humans:** Overexposure increases the risk of skin cancer and eye damage.
- **Plants:** Affects growth traits like leaf size, biomass, chlorophyll, and secondary metabolites; impact depends on species and dose.

Transmission Line Easements and Sustainable Agriculture

As climate change and cities expand, these areas offer space for low-height, eco-friendly farming.

Success depends on local conditions, especially sunlight and light intensity.

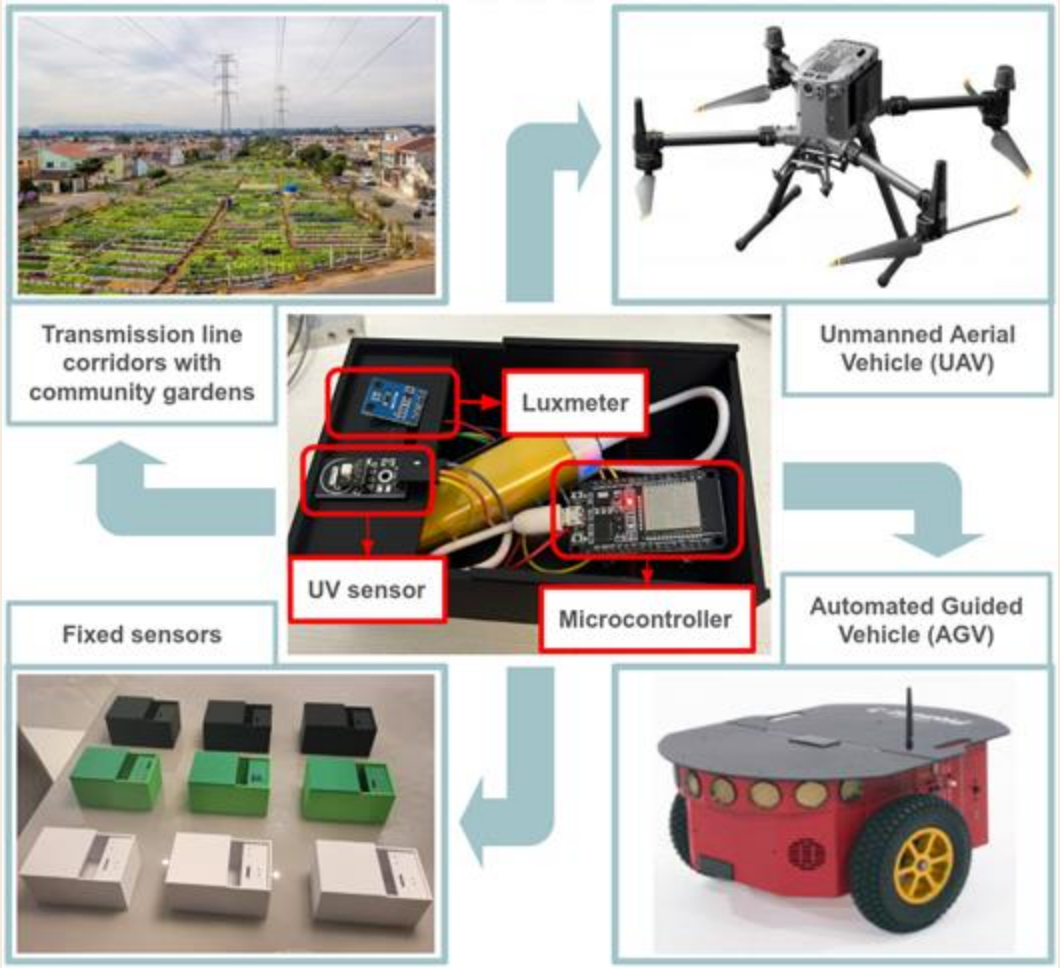
Proposed Methodology

Combines fixed sensors and mobile robotic units to map radiation and light intensity.

Enables scalable, spatially distributed data collection.

Identifies microzones with unique agricultural potential.

Supports sustainable farming in non-traditional areas using modern sensor tech and data-driven strategies.


Transmission line corridors with community gardens
Unmanned Aerial Vehicle (UAV)
Luxmeter
UV sensor
Microcontroller
Fixed sensors
Automated Guided Vehicle (AGV)

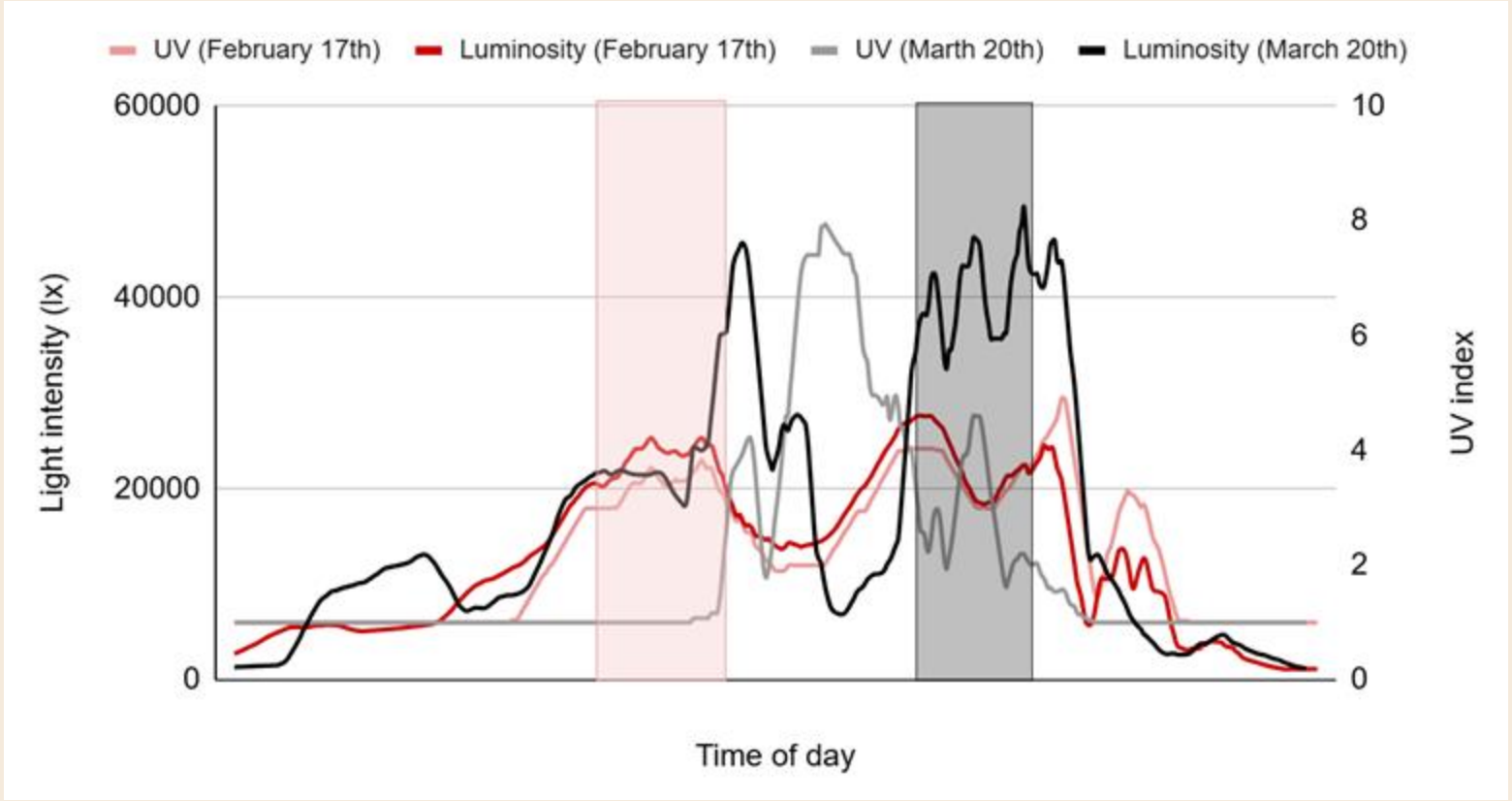
Experimental Setup

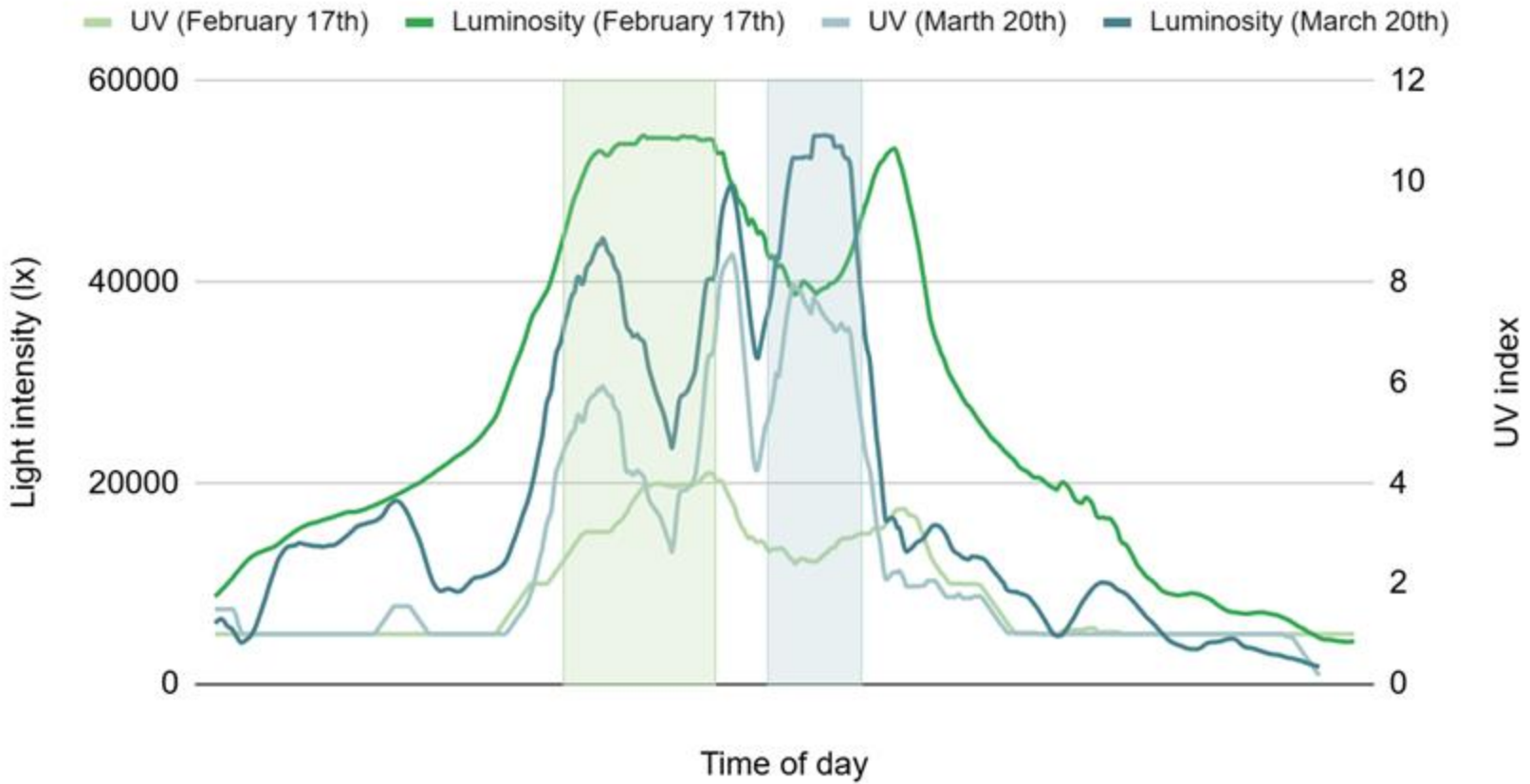
Location: UFPR's vegetable garden, Curitiba, Brazil (–25.441105, –49.276855), subtropical climate.

- Nearby 13.8 kV power lines simulate utility easement conditions.
- 9 fixed points, data collected every second from 7:30 AM to 5:30 PM.

The units

- Components: ESP32, UV Sensor (UVM30A or LTR390), BH1750 (light sensor).
- Enclosed in 3D-printed boxes (black, white, green) to test housing color effects.
- UV sensors function in temperatures from –40 °C to 85 °C.


UV (February 17th)
Luminosity (February 17th)
UV (Marth 20th)
Luminosity (March 20th)
60000
40000
20000
0
Light intensity (lx)
10
8
6
4
2
0
UV index
Time of day


UV (February 17th)
Luminosity (February 17th)
UV (Marth 20th)
Luminosity (March 20th)
60000
40000
20000
0
Light intensity (lx)
12
10
8
6
4
2
0
UV index
Time of day

11

- Light and UV readings followed similar patterns across points.
- Influenced mainly by vegetation and shading from obstacles.
- Box color had minimal impact on sensor readings.
- However, it affected internal temperatures, potentially influencing electronics performance.

Future Works

- Use of ground and aerial robots to improve scalability and mapping precision.
- Goal: More accurate, localized measurements and context-aware solutions.
- Plan to expand sensor network with:
  - Air & soil humidity
  - Internal & external temperatures
- Supports better decision-making and evaluation of sustainable farming potential.

Acknowledgments

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