Distributed Acoustic Sensing for Electric Grid Monitoring

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Introduction

- Optical fiber networks play a crucial role in electric grid monitoring.
- Distributed Acoustic Sensing (DAS) leverages backscatter principles to detect disturbances.
- IoT and Machine Learning enable predictive maintenance and fault detection.
- DAS provides real-time insights into grid health.
- Reduces downtime and maintenance costs significantly.

Project Objectives

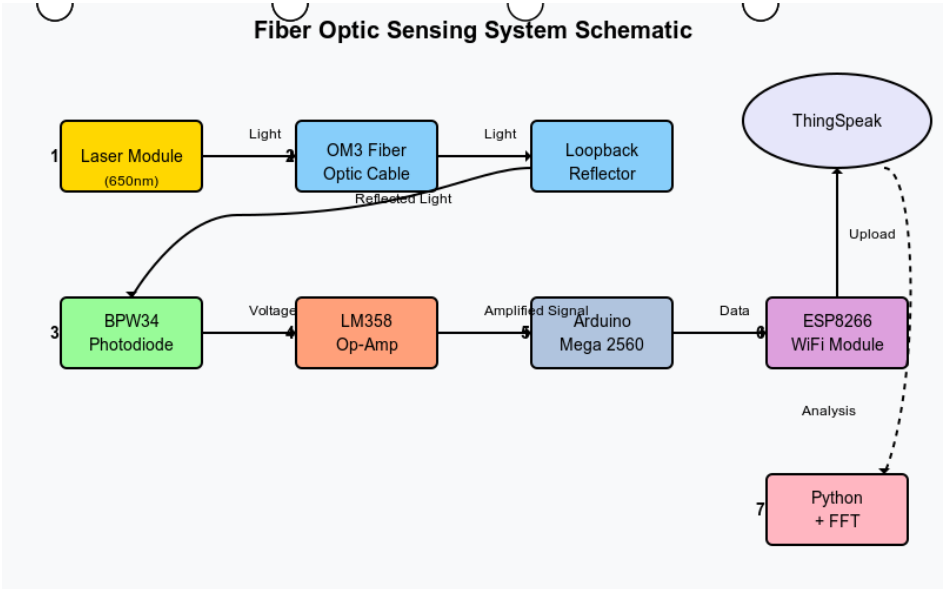
- Develop a system utilizing DAS for monitoring signals in optical fiber.
- Improve grid reliability and reduce maintenance costs.
- Utilize IoT sensors and ML algorithms for real-time disturbance detection.
- Implement a scalable system adaptable to various environments.
- Validate system effectiveness through real-world testing.

Methodology Overview

- **Hardware**: 650nm Laser, BPW34, LM358, Arduino Mega, ESP8266.
- **Signal Processing**: Photodetector converts light variations to voltage.
- **Data Analysis**: FFT for frequency detection, ML for pattern recognition.
- **Cloud Integration**: Data uploaded to ThingSpeak for visualization.

Circuit Flow

- Laser transmits signal through fiber.
- BPW34 detects intensity variations.
- LM358 amplifies signal.
- Arduino processes sends data to ESP8266.
- Data uploaded to ThingSpeak.



Current Progress

- Software Implementation (Arduino + Python + ThingSpeak).
- Circuit Design Simulation.
- ML FFT Code Integration.

Expected Results

- Accurate vibration detection using fiber optics.
- Real-time cloud monitoring through ThingSpeak.
- ML model predictions for anomaly detection.

Conclusion Takeaways

- Successful DAS implementation using affordable components.
- FFT ML enhance signal accuracy.
- Potential for real-world applications in security monitoring.

References

- **[1]** https://www.mdpi.com/2304-6732/12/1/7
- **[2]** https://www.nature.com/articles/s41467-022-31681-x

Questions?

Thank You!