IoT Gateway for Commercial Smoke Detectors

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Co-funded by the European Union
ARCA
ARtificial intelligence platform to prevent Climate change natural hazArds
2nd ARCA WORKSHOP
ON ARTIFICIAL INTELLIGENCE AND CLIMATE CHANGE HAZARDS
AI • IoT • DATA • RESILIENCE EARLY WARNING SYSTEMS
Bringing together researchers, engineers, policymakers and innovators to design and discuss AI-driven platforms that predict, prevent and respond to natural hazards and build a more resilient future.
09–13 JUNE 2026 (5 DAYS)
BUDVA, MONTENEGRO Akademija Znanja
HYBRID FORMAT ON-SITE + ONLINE
WITHIN MECO 2026 CONFERENCE
DEADLINE FOR SUBMISSION 25 MAY 2026
ABOUT THE WORKSHOP
The 2nd ARCA Workshop focuses on how Artificial Intelligence and emerging technologies can help us understand, monitor and mitigate the impacts of climate change and natural hazards.
We invite contributions from different disciplines and sectors to foster collaboration, share knowledge and co-create innovative solutions.
TOPICS OF INTEREST
AI for wildfire, flood and landslide prediction
AI for detection of rapid and slow climate changes
Satellite data analysis for environmental modeling
Sensor networks and edge AI in remote or at-risk regions
Agriculture, tourism and other sectors in time of climate changes
Education for mitigation and disasters management
Citizen-driven AI tools for environmental risk mapping
Decision Support Systems for natural hazards and air quality monitoring
Ethical and sustainable AI for climate adaptation
WHO SHOULD ATTEND?
Members of ARCA project consortium
AI/ML developers, data scientists
Climate/environmental researchers
NGOs, policy-makers and emergency responders
Students and startups in tech-for-good initiatives
Anybody interested
WORKSHOP FORMAT
Thematic presentations
Hands-on sessions, lightning talks and collaborative prototyping
Real-world case studies and data challenges
Opportunities to join ongoing ARCA project as associate and supporting member
SUBMIT & REGISTER
Submit a short expression of interest, abstract of your speech or pitch idea by 25/5/2026 via the submission form.
SCAN ME
mecoconference.me/special-sessions/#arca
ORGANIZERS & PARTNERS
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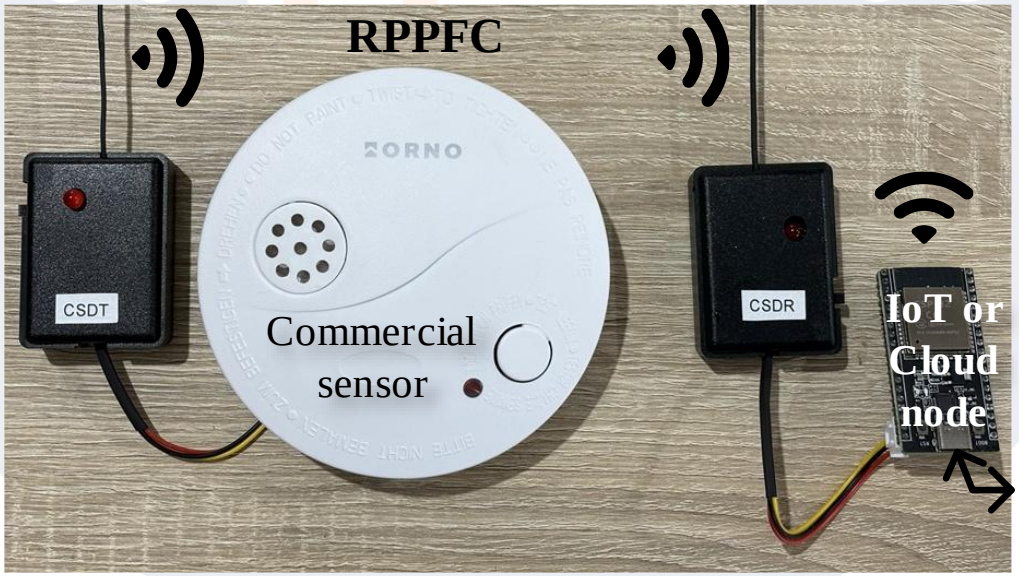
#AIforGood
#CrossBorderCooperation

Problem & Motivation

- Traditional detectors only provide local alarms
- Large facilities need remote alerts
- Existing IoT solutions often use uncertified sensors
- Goal: Add IoT capabilities to certified detectors

Proposed Architecture

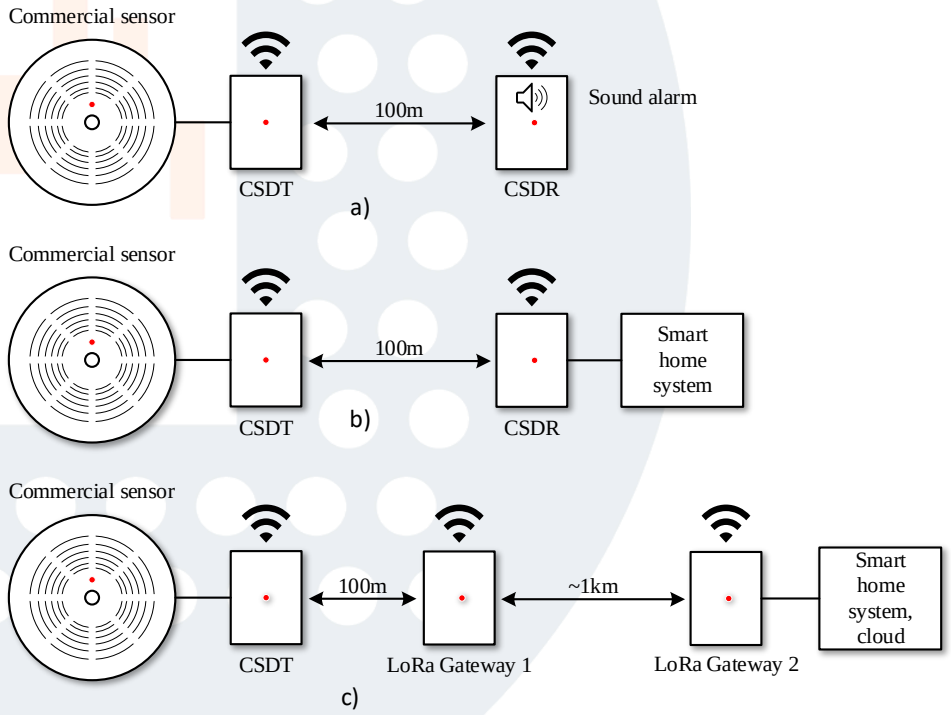
- Commercial Smoke Detector Transmitter (CSDT)
- Commercial Smoke Detector Receiver (CSDR)
- Random Pause Pulse Frequency Coding (RPPFC) wireless protocol
- Preserves detector certification and reliability



Integration Scenarios

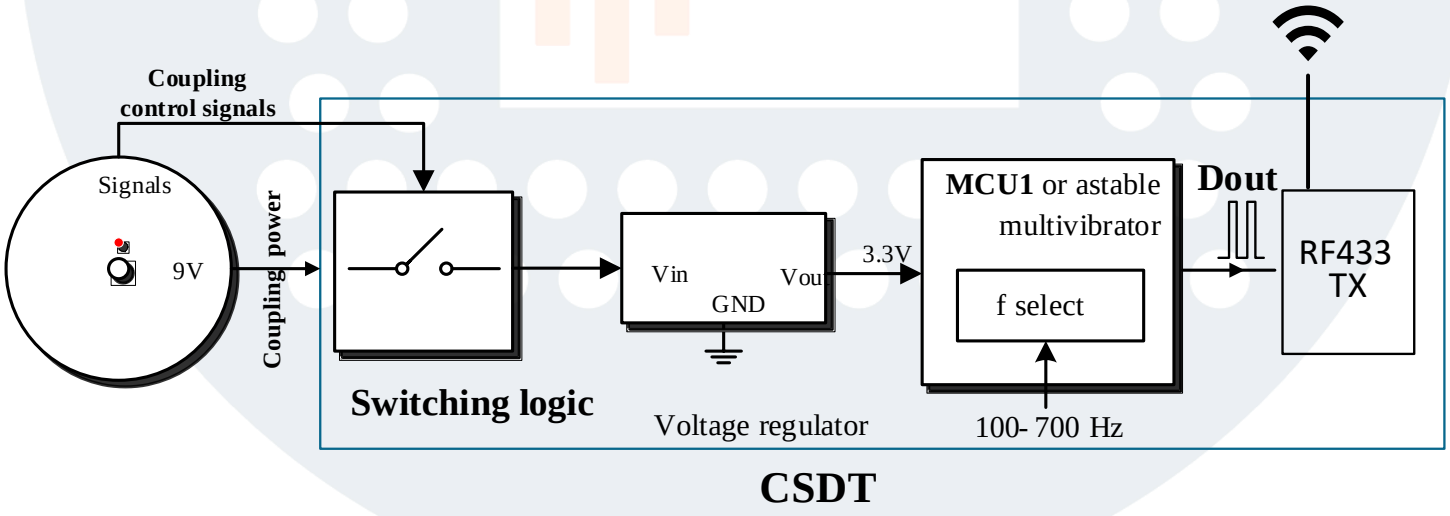
- Standalone remote alarm systems
- Smart home integration
- IoT / cloud monitoring platforms
- Optional LoRa extension

(~1 km)



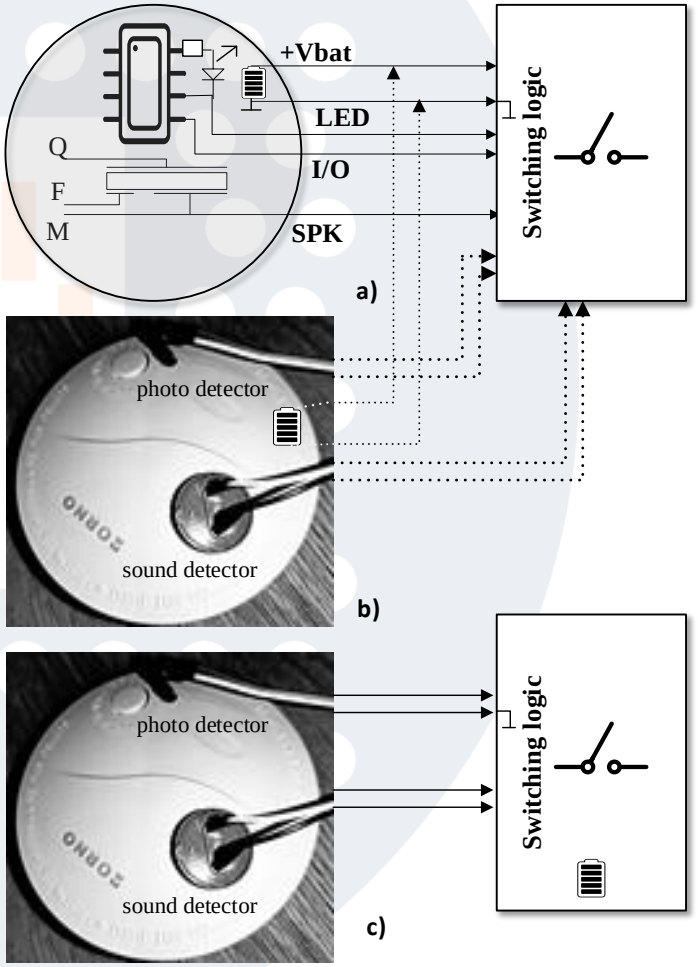
CSDT Design

- Uses detector power/alarm signals
- Activates only during alarm events
- RF433 transmitter + ATtiny85 MCU
- Ultra-low standby consumption



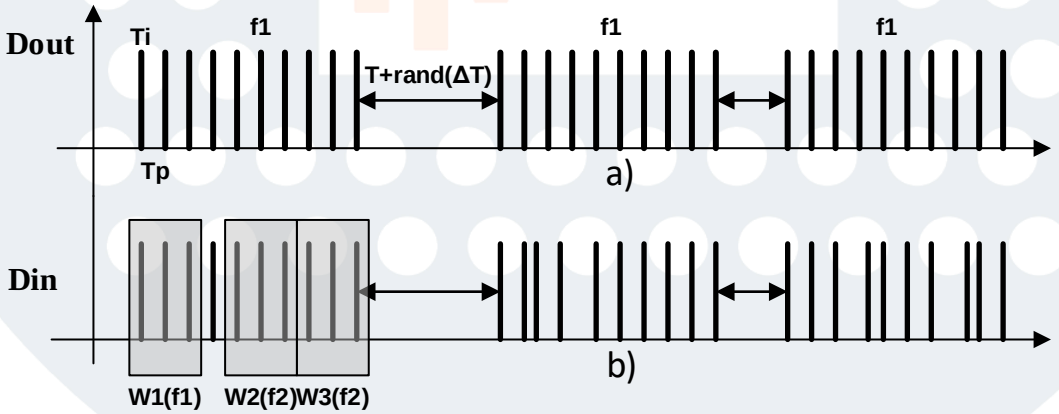
Signal Coupling Methods

- Fully invasive: highest reliability
- Minimally invasive: microphone + LED sensing
- Non-invasive: external sensing only
- Trade-off between reliability and installation effort



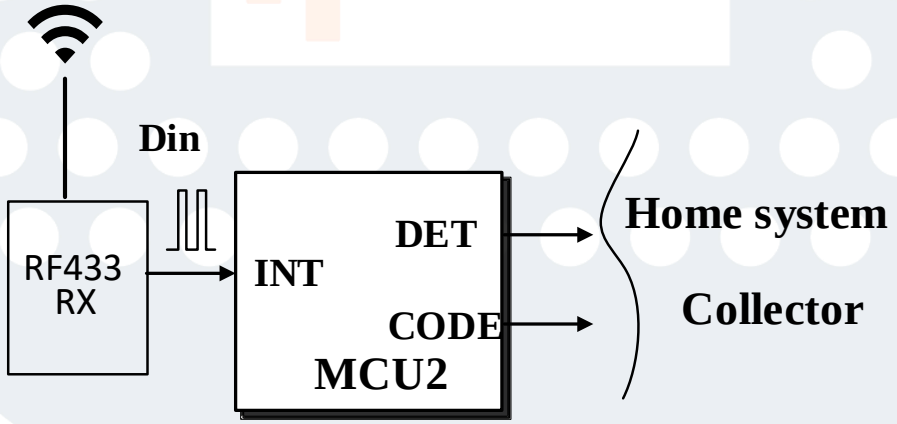
RPPFC Communication Protocol

- RF433-based transmission
- Randomized transmission intervals
- Reduces collisions and interference
- No ACK or network infrastructure required



Receiver & Detection Logic

- Rule-based signal validation
- Frequency tolerance checking
- Optional duty-cycle validation
- Reduces false alarms



Experimental Results

- Open field range: ~98–100 m
- Indoor range: ~60 m
- LoRa extension: ~950 m
- PRR >95% and low latency
- Near-zero standby power (invasive methods)

Conclusions

- Retrofit solution for certified detectors
- Reliable and low-power IoT integration
- Improved communication with RPPFC
- Cost-effective and scalable
- Future work: IoT platform integration & deployment

Thank you, Q&A?

To project:

ARCA: ARtificial intelligence platform to prevent Climate change natural hazArds

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