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SADmote:

A Robust and Cost-Effective Device for Environmental Monitoring

ERAF IEGULDĪJUMS TAVĀ NĀKOTNĒ
EIROPAS REĢIONĀLĀS ATĪSTĪBAS FONDS
Work supported by ERDF grant No. 2010/0317/2DP/2.1.1.1.0/10/APIA/VIAA/142

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Introduction

SADmote [sʌdmɔ:t] – sensor mote for environmental monitoring in precision agriculture
- S.A.D. – abbreviation for “Sensors in a Fruit Garden” in Latvian
- “Sad” means “orchard” in Russian

Project developed in cooperation with Latvia State Institute of Fruit Growing <<http://lvai.lv/>>

Motivation

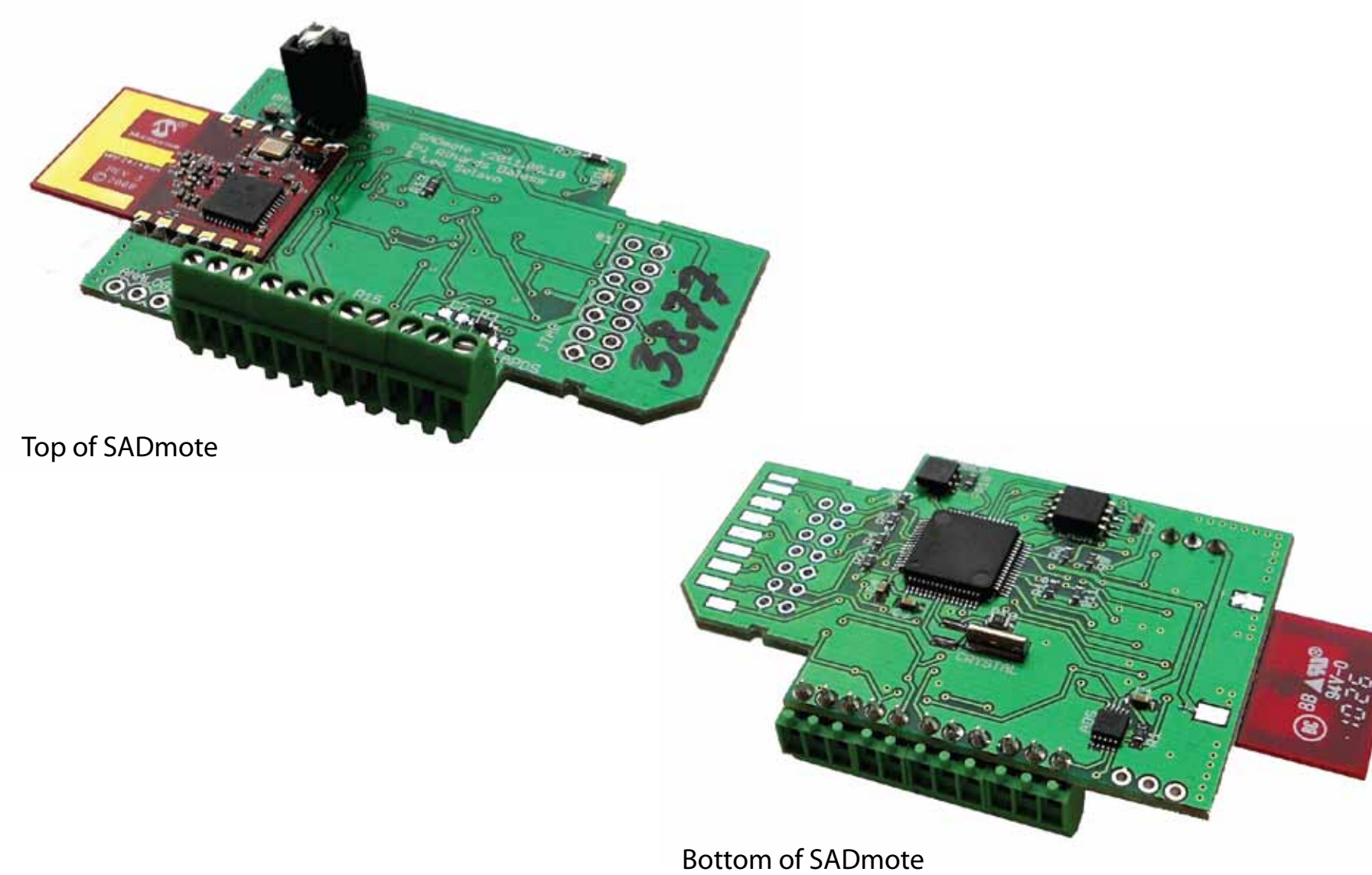
Environmental scientists require distributed, accurate and easy-to-collect microclimate measurements in an orchard to study environmental effects on fruit plantations under protective covers.
Device should last during whole vegetation season, have small dimensions, be expandable with various sensors, have radio communications and should be relatively cheap to produce.

SADmote Features

- Energy-efficient low power mode
- circa 30 μ A @ 3V without sensors
- Able to function from two AA type batteries
- Radio communication range typical for low power 802.15.4 radios: ~150m outdoors

SADmote Hardware

- Low power microcontroller TI MSP430F1611
- 2.4GHz radio module Microchip MRF24J40
- 2MB external flash memory Atmel AT25DF16
- Unique serial number Maxim DS2401P+
- Additional 16bit ADC chip TI ADS1114/ADS1115
- Programming interface in form of SD card connector
- Runs on MansOS WSN operating system
- Costs less than 100\$

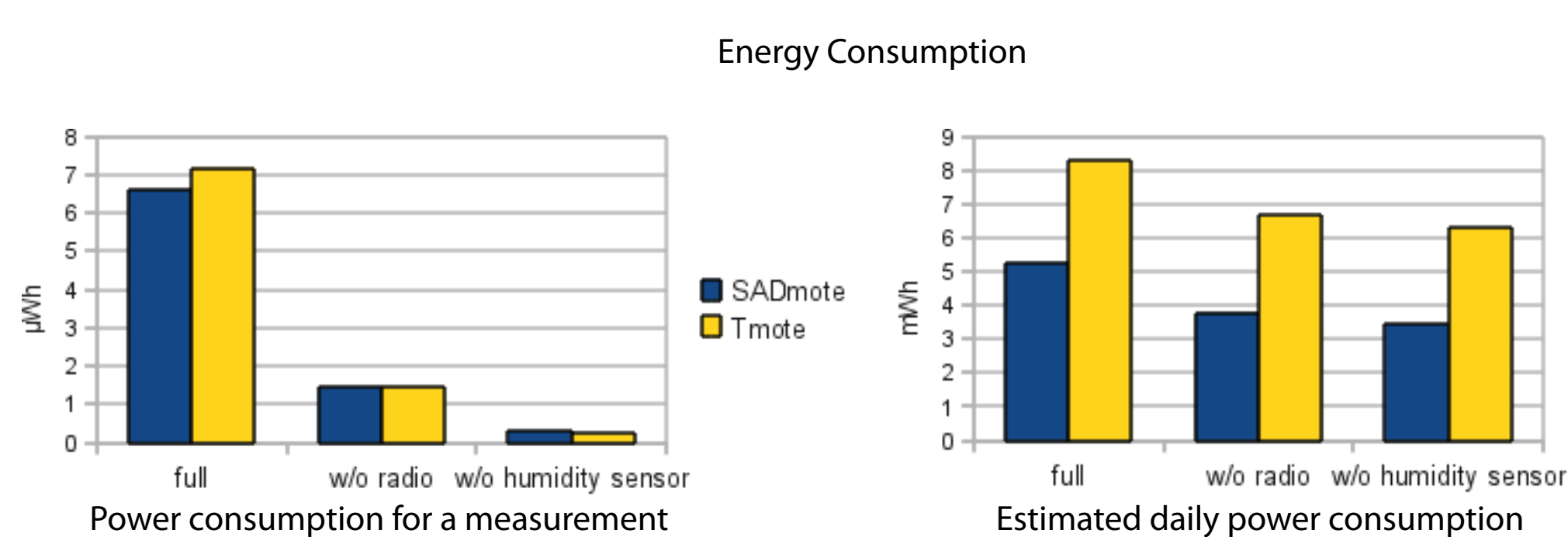


SADmote Software

- Open source WSN operating system
- Multi-hop routing
- Multiple threads
- Over-the-air reprogramming
- Drivers for all hardware used

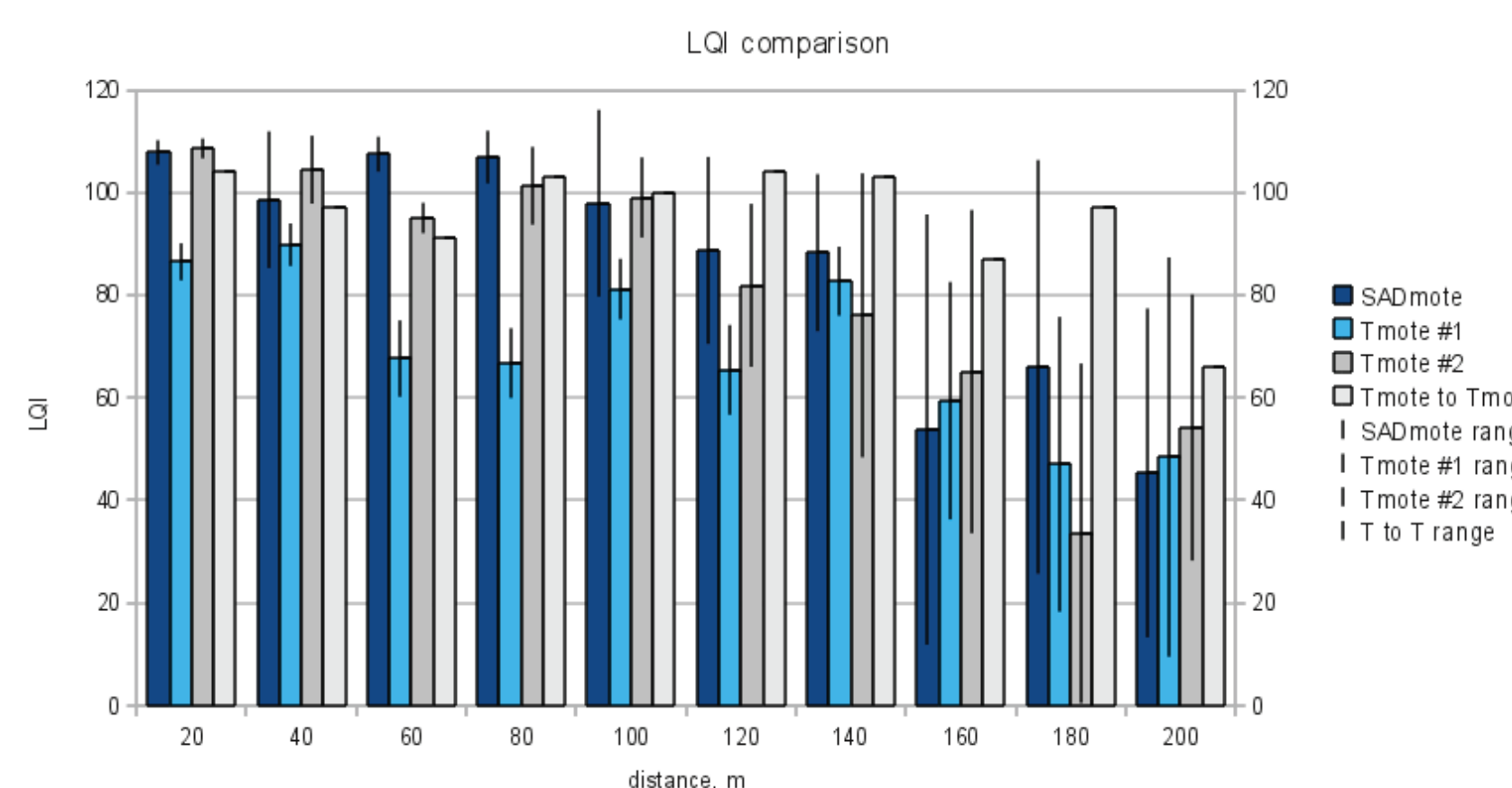
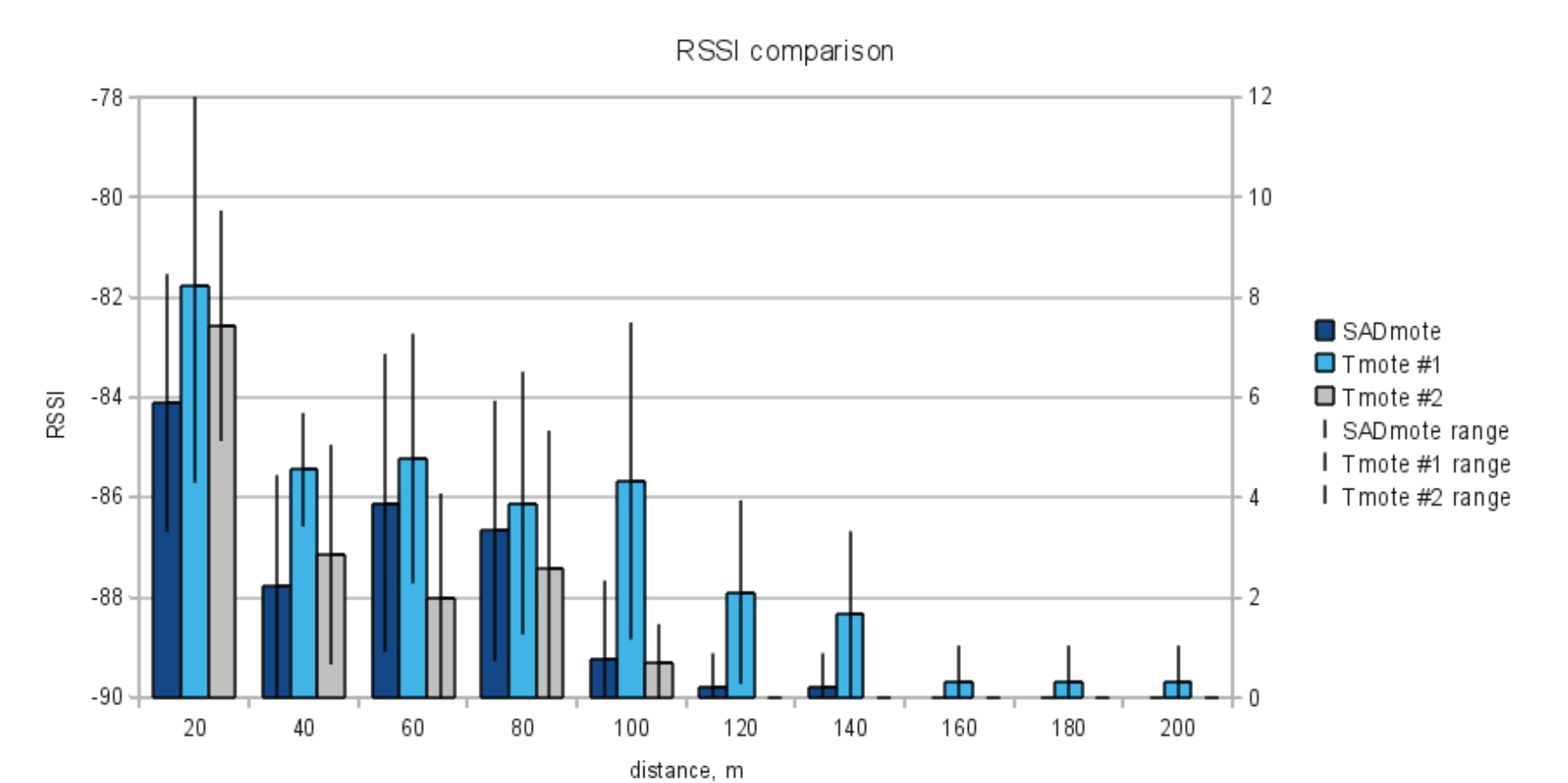
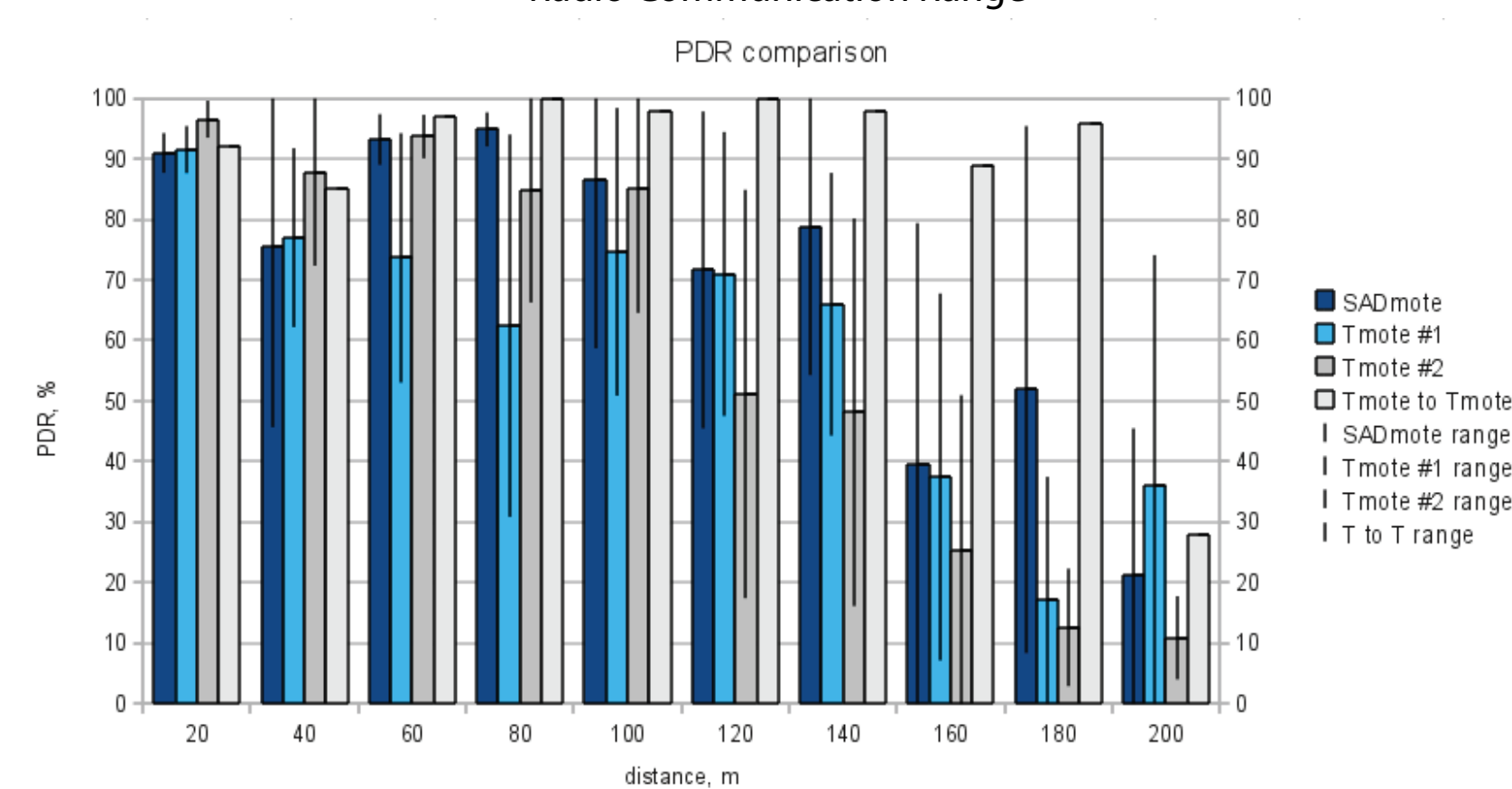


Evaluation

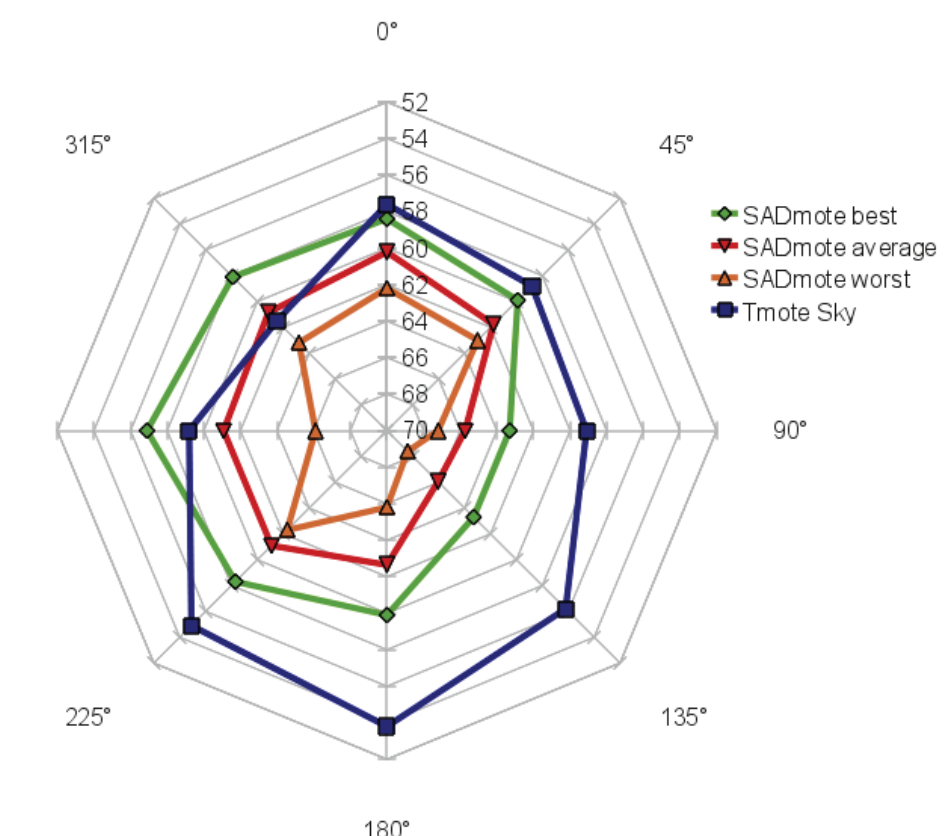


Operation		SADmote	Tmote Sky
Active	Measured Datasheet	7.5mW	6.9–8.4mW
		-	7.2mW
Sleep	Measured Datasheet	90.0μW	210μW
		-	163.5μW
Radio receive	Measured Datasheet	76.5mW	63.9mW
		-	65.4mW

Radio Communication Range

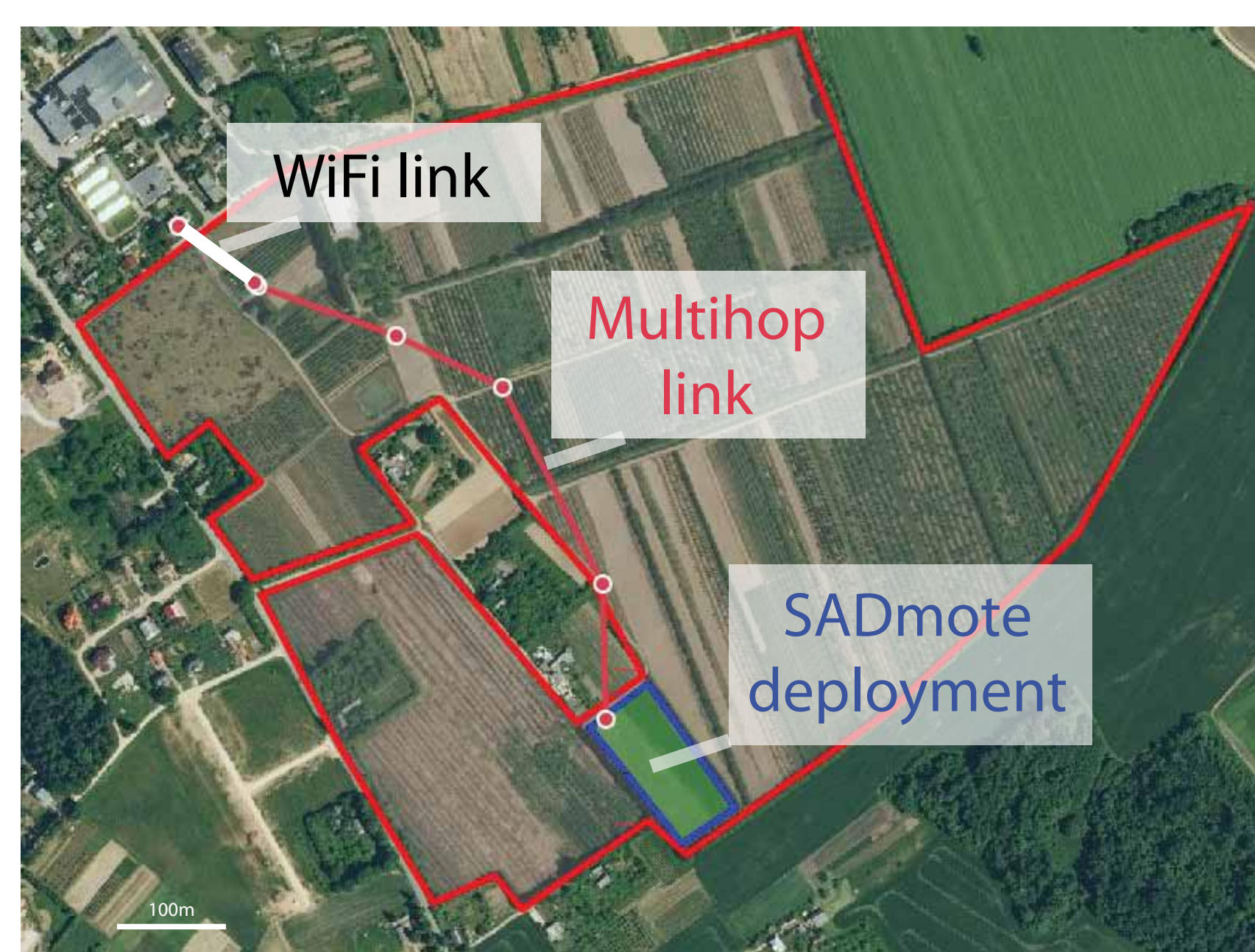
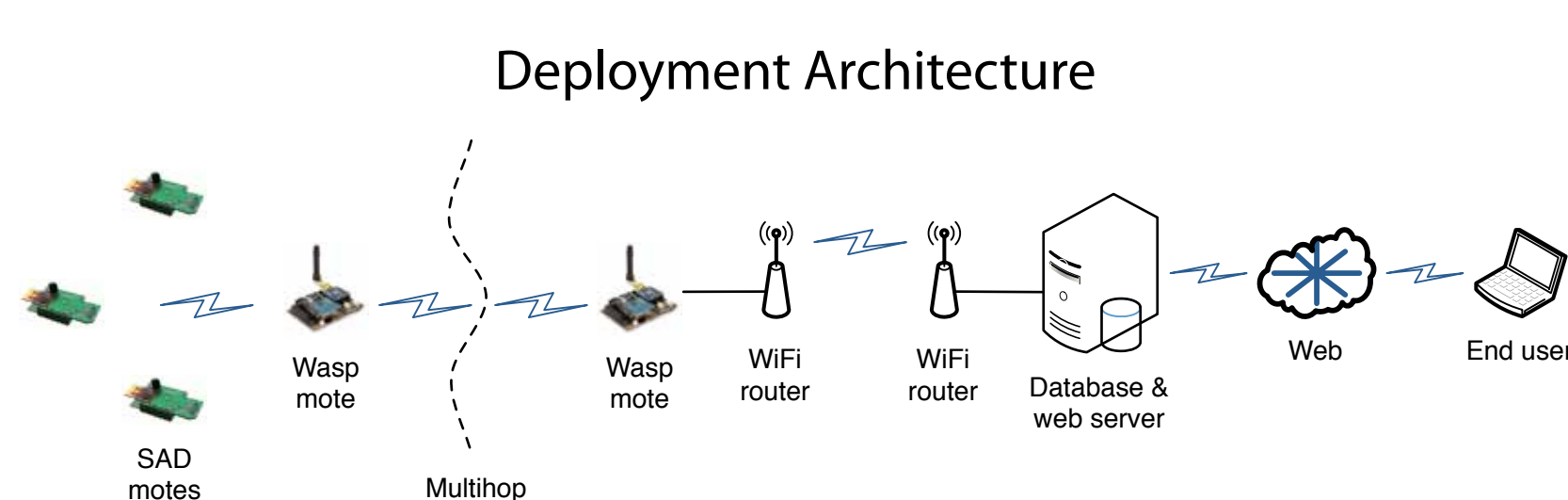


Radio Directionality



Evaluation: Field Deployment

- Total 12 SADmotest deployed from September 19 to November 2, 2011
- One measurement every 5 minutes
- Approx. 57000 measurements collected in total



Evaluation Results

- Forwarding layer not working well - only about 100 measurements reached database server
- Radio driver stability issues
- Sensor extension boards were not well enough protected from weather impact
- Time accounting worked well despite lack of dedicated real-time clock chip



SADmote v3

Next generation SADmote with:

- More powerful yet lower energy consuming microcontroller TI MSP430F5438A with integrated Real-Time Clock
- New radio module Amber Wireless AMB8420 for usage in 868MHz band
- MicroSD card for data storage