Ubiquitous Agriculture (u-Agri)

Precision Farming through WSN

Santosh Sam Koshy, P. Sowjanya Reddy, Y. Nagaraju, Dr. N. Sarat Chandra Babu, Dr. C. Kathiresan, Mahesh U. Patil

Centre for Development of Advanced Computing (C-DAC), Hyderabad

About C-DAC

- Centre for Development of Advanced Computing (C-DAC) is a Scientific Society of the Ministry of Communications and Information Technology, Government of India

- C-DAC, is primarily an R&D institution involved in the design, development and deployment of electronics and advanced Information Technology (IT) products and solutions including the celebrated PARAM series of super computers.

- The head quarters is located in Pune, with 11 centres across the country

C-DAC, Hyderabad

- C-DAC, Hyderabad is working in R&D with a focus on system level programming,web technologies and embedded programming in the application domains of
  - Ubiquitous Computing
  - Network Security
  - E-Learning
  - India Development Gateway (www.indg.in)
  - Information Security Education & Awareness (www.infosecawareness.in)
  - Supply Chain Management

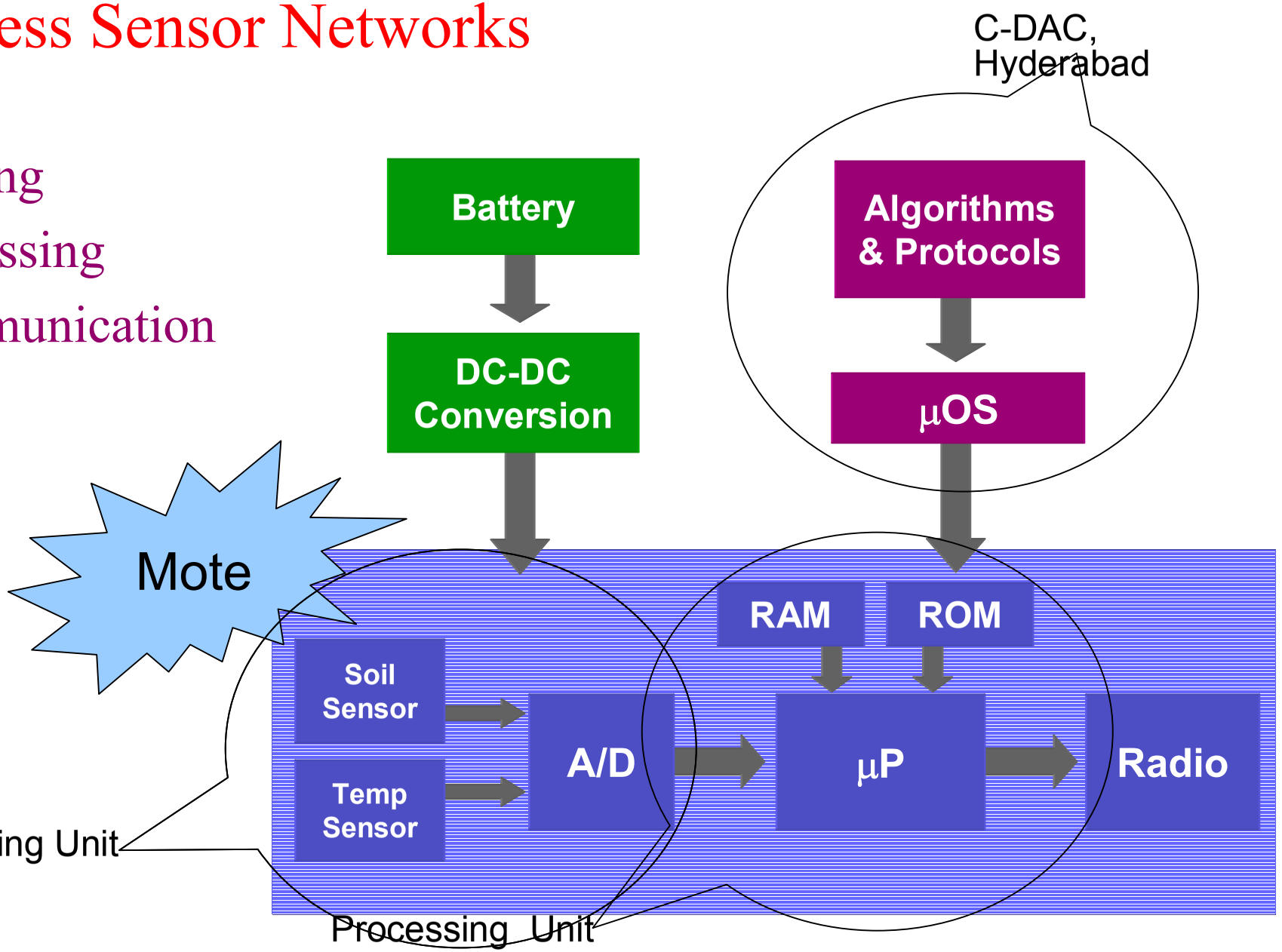
Problem Definition

- Stagnancy in the Green Revolution
- Sustainable Agriculture
- Spatial Variability in climatic conditions
- Temporal validity of existing weather data
- Manual intervention for data collection
- Limitations of existing methodologies of precision farming

Methodology Proposed

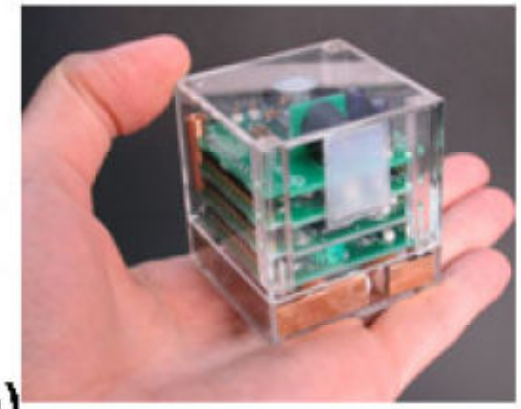
Wireless Sensor Networks

- Sensing
- Processing
- Communication



Mote

- Wireless off-the-shelf sensor node

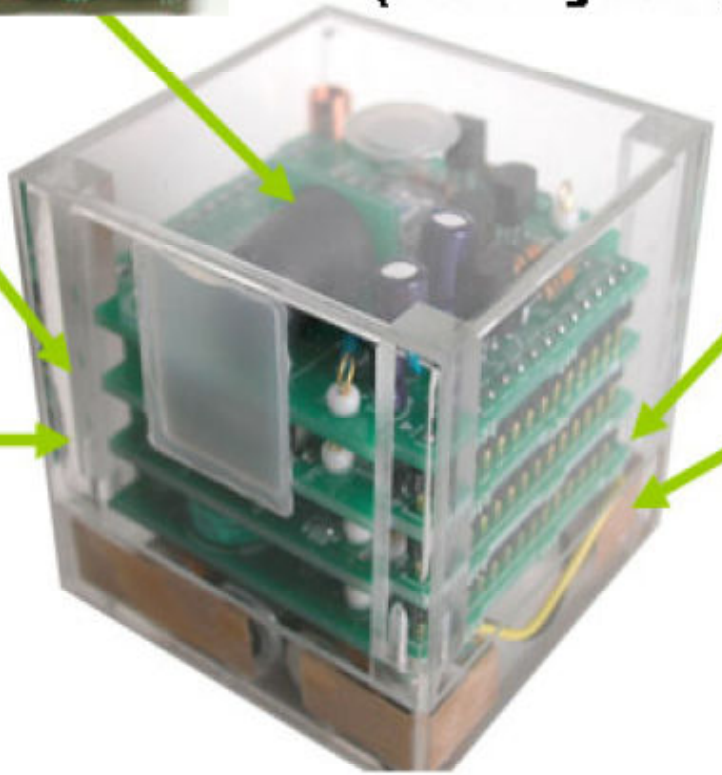




CPU.



- Sensor Board
  - Motion Sensor
  - Illuminometer
  - Thermometer
  - (exchangeable)







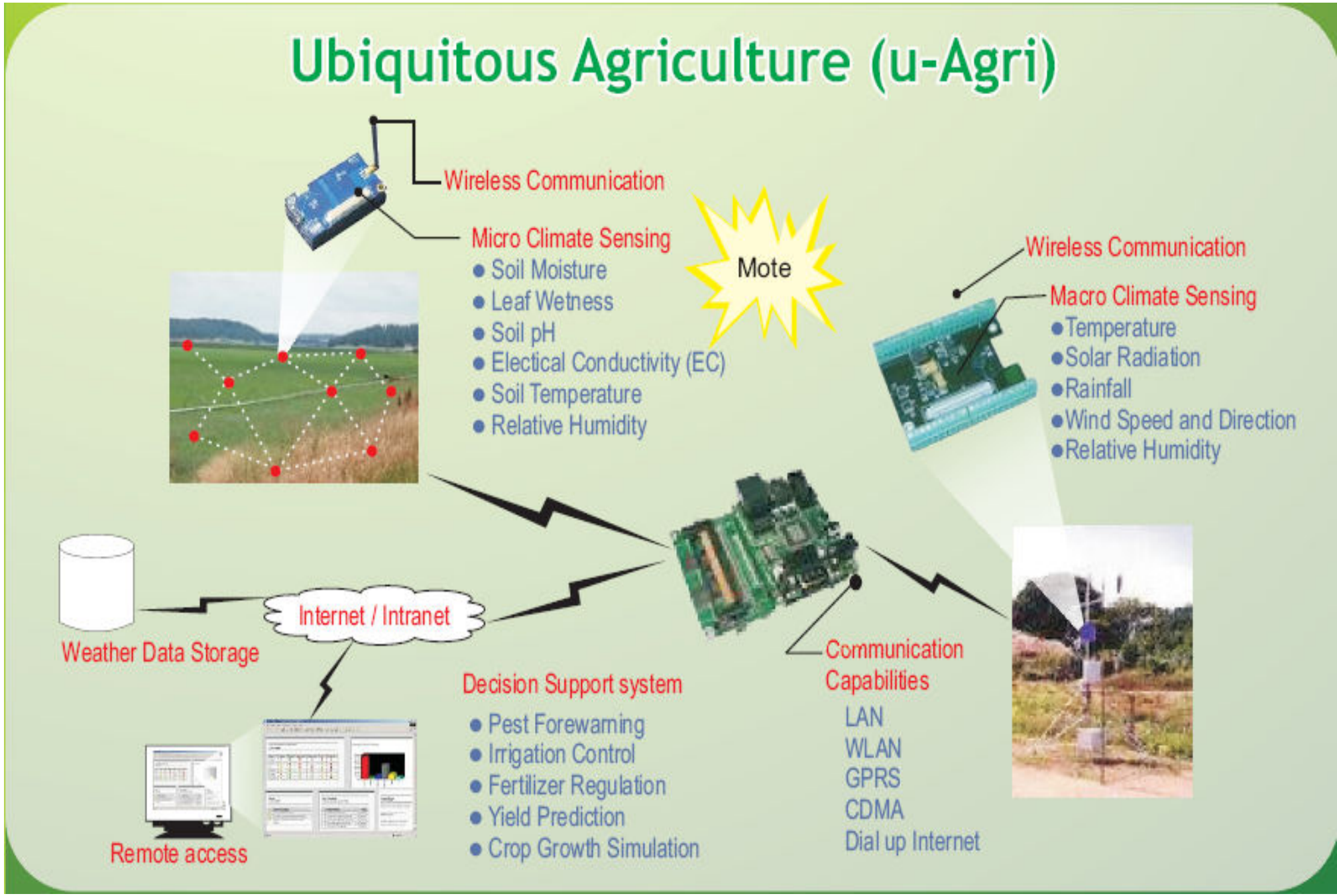
Power Mgmt.



Wireless Comm.
IrDA Comm.

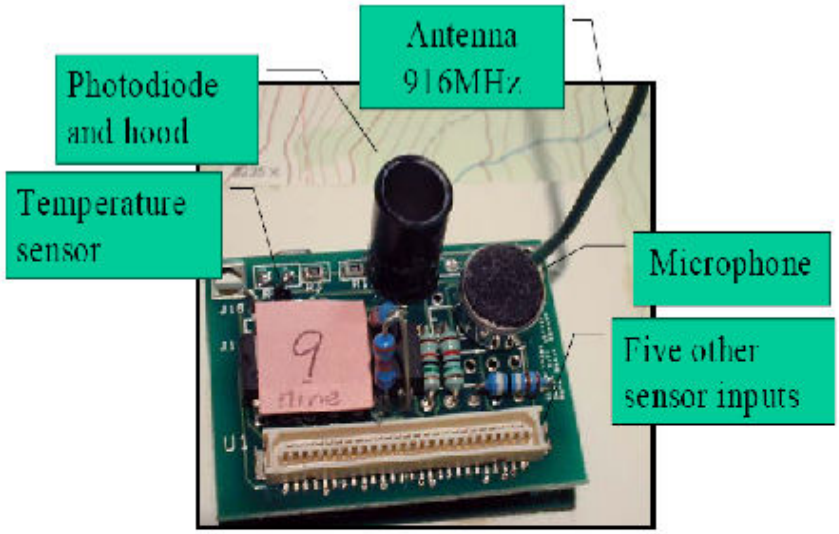


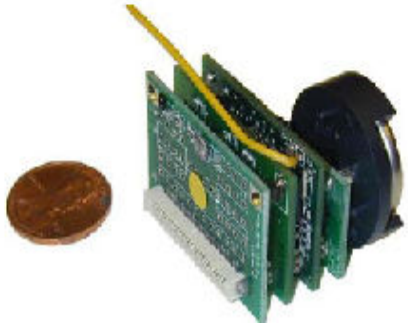
System Architecture



Hardware Specifications of a Mote

- CPU
  - 8-bit, Atmel Processor
  - No floating-point arithmetic support
- **Radio**
  - **2.4 GHz ISM Band @ 250 Kbps**
  - Distance **30-100ft** Single Hop. Latest systems support upto **500 meters LOS**
- Storage
  - 8 KB instruction flash
  - 512 bytes data RAM & EEPROM
- OS
  - **TinyOS**, event driven (3.5KB code space)
- **Sensing**
  - **light,** sound, **temperature**, acceleration, magnetic field, pressure, **humidity,** RF signal strength, **soil moisture**, **EC**, **pH**





Applications in Agriculture

- Replicate Automatic Weather Stations
- Pest Prediction Systems
- Irrigation Management Systems
- Soil pH and EC Analysis
- Controlled farming in Green House Deployments

Features of a WSN based Agri System

- Greater precision data
- Remotely programmable
- Remote data Monitoring
- Increased lifetimes
- Integrable to existing DSSs
- Macro and Micro Climatic sensing
- State of the art technology

C-DAC's contribution

- Design and development of Routing, Dissemination and Time Synchronization algorithms for WSN

- Research in pilot level system for proof-of-concept of WSN technology. System capable of sensing environmental parameters like temperature, light, relative humidity and atmospheric pressure

- Validation of temperature values received from WSN with existing Stevenson's aparatus, at Agricultural Research Institute

Work in Progress

- National project in setting up of National Level Ubiquitous Computing Research Centres
  - Setting up a WSN based Agricultural system in collaboration with key Agricultural Research Organizations
  - Indigenous development of hardware to combat high costs
  - Remote control of WSN system to reduce manual interventions

Existing WSN deployments in Agri

- Sensor Net Data Acquisition system (CENS)
  - http://www.cens.ucla.edu/~mhr/daq/sensors.html
- Fighting phytophtora in potatoes using Micro Climate (LOFAR)
  - http://www.lofar.org/p/Agriculture.htm
- Wireless Sensor Network vineyards (Intel Research)
  - http://www.intel.com/research/vert_agri_vineyard.htm
- Camalie Net Wireless Sensors (California)
  - http://camalie.com/WirelessSensing/WirelessSensors.htm
- Soil moisture monitoring with WSN (UWA)
  - http://www.csse.uwa.edu.au/adhocnets/WSNgroup/soil-water-proj/
- SPANN Lab (IIT Mumbai)
  - http://www.ee.iitb.ac.in/spann/sulavines_deployment.html
- COMMON-Sense Net (IISC B'lore)
  - http://commonsense.epfl.ch/

India Development Gateway (InDG)

www.indg.in

indg INDIA Development Gateway



Agriculture



Health



e-Governance



Rural Energy



Primary Education

A Multi Lingual Portal for Rural India

Focus:

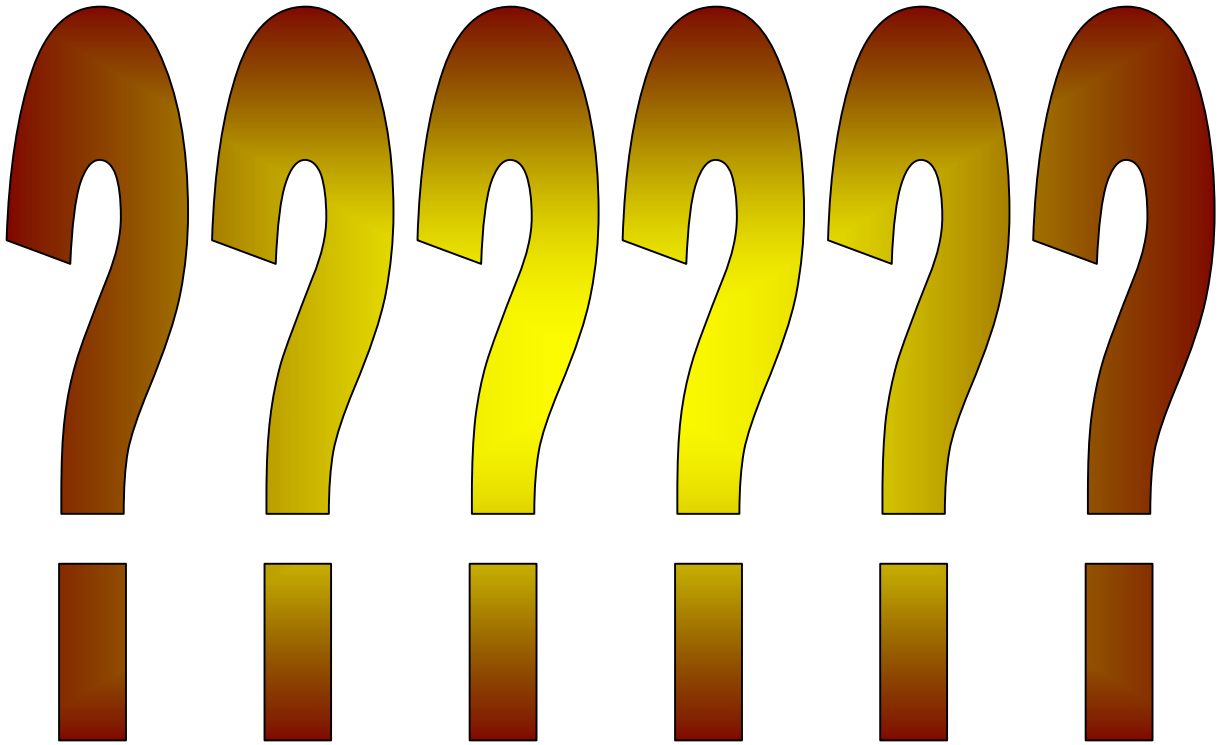
- *Reaching the Unreached*
- *Products & Services in Local Languages*
- *Strengthening Outreach Partners*

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