



SMART GREENHOUSE

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CONTIKI-NG

Networked Embedded System Project 2018/2019

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Scenario

There are many problems that afflicts the agriculture:

- ▶ Excessive water consumption in traditional greenhouse
- ▶ Cultures are exposed at drastic climate change
- ▶ Risk of losing totally or partially the harvest
- ▶ Useless human intervention for the plants' monitoring



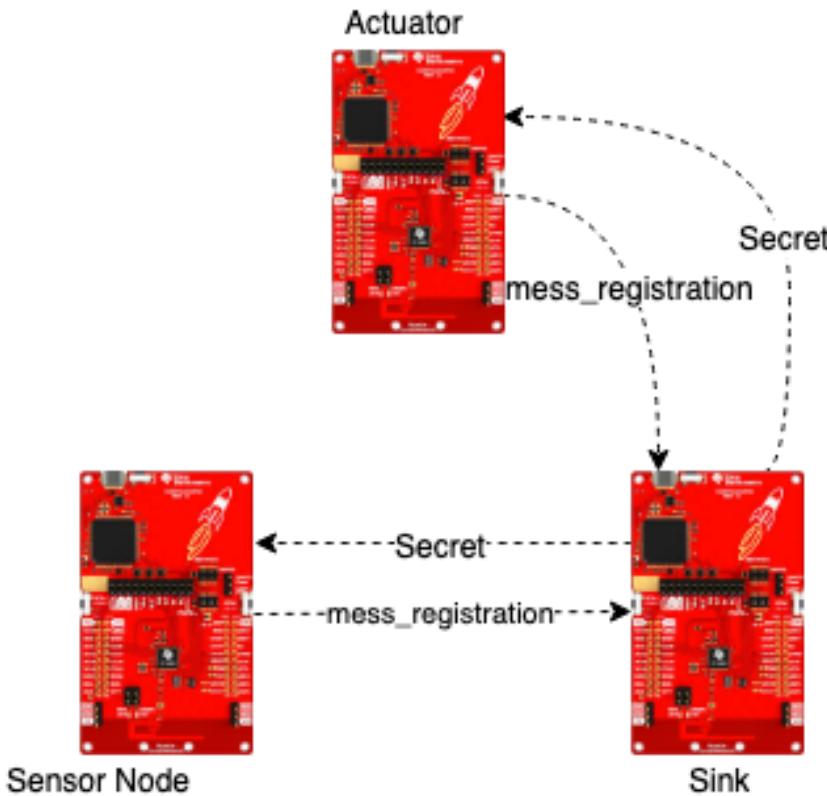


Proposed Solution

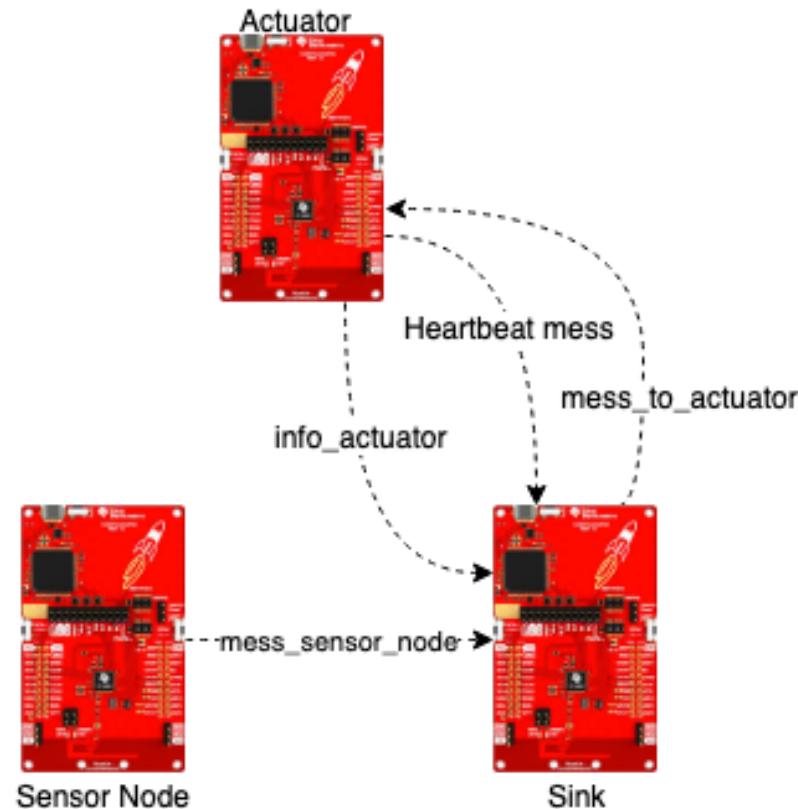
- ▶ Smart Network of Wireless Sensors
 - ▶ Remote monitoring of the plantation
 - ▶ Automated system with programmable behavior
 - ▶ Failure monitoring and notifications to the farmer
 - ▶ Multi-sensor architecture
 - ▶ Node authentication with shared secret
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Message Protocol

► Registration phase



► Operative phase

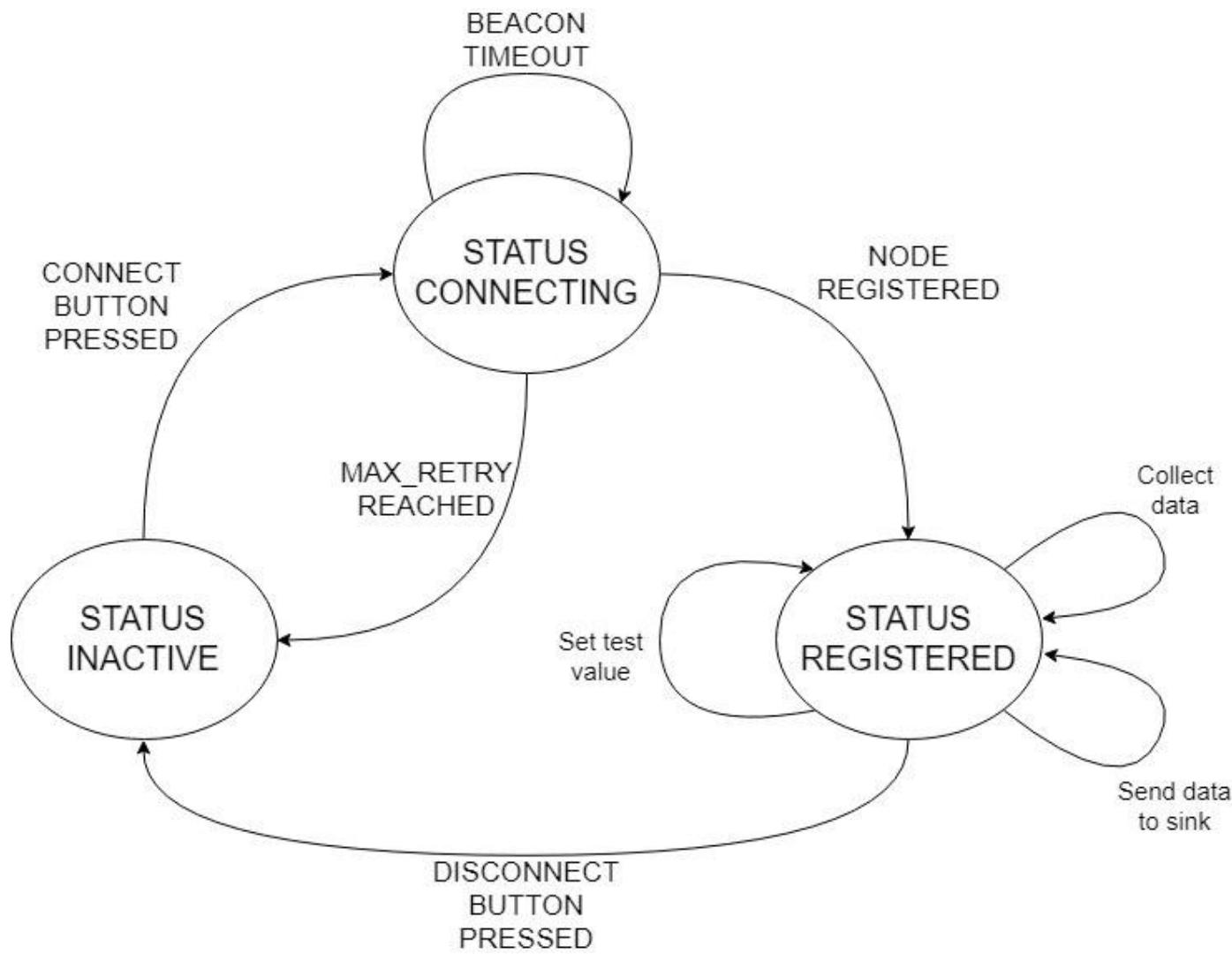


Sensor Node



- ▶ Collects environmental data and performs data aggregation
- ▶ Adjustable duty cycle for data collection and transmission
- ▶ Sensors are activated/deactivated dynamically
- ▶ Status (of the node) reported by means of LEDs

Sensor Node

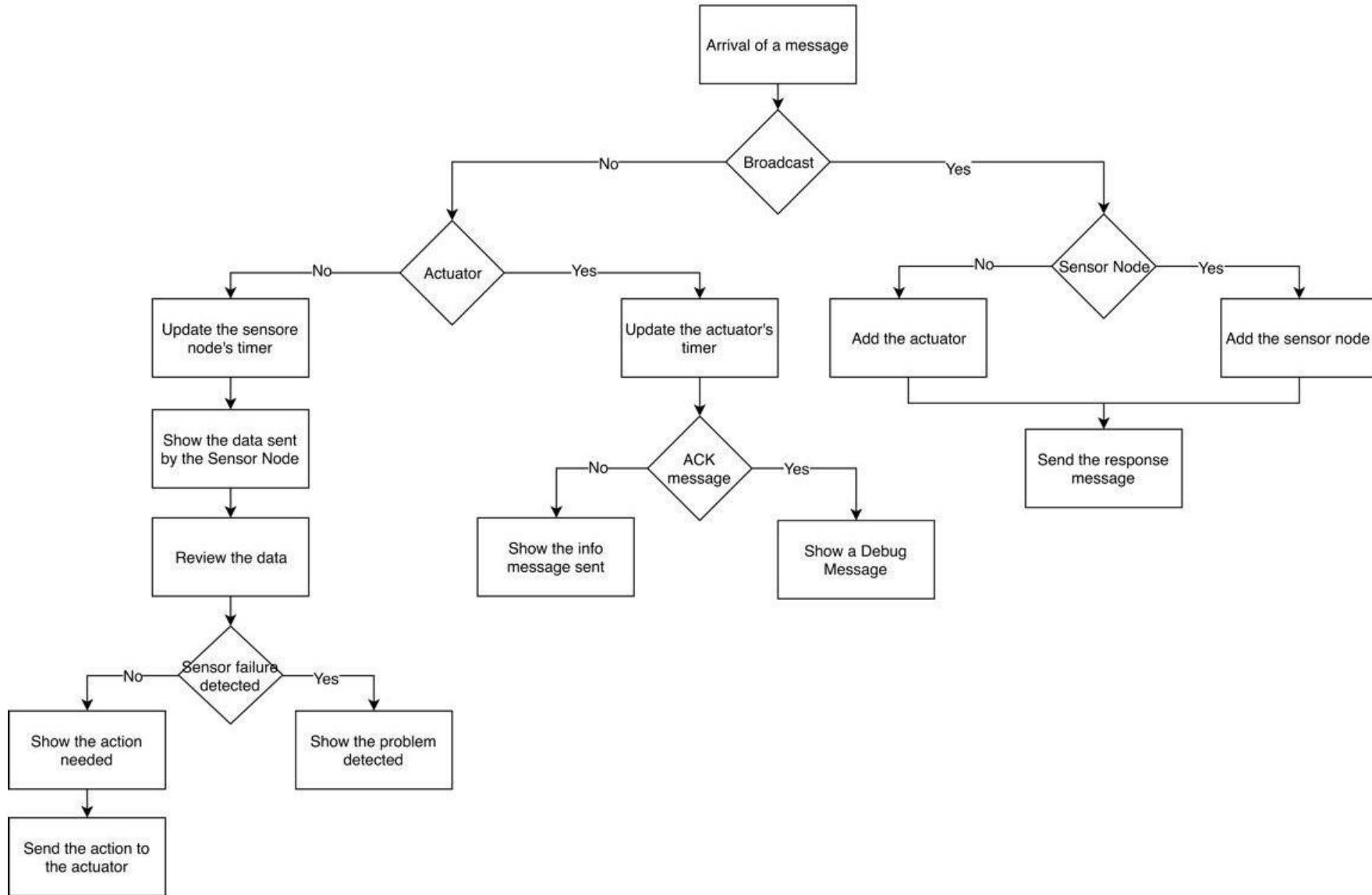


Sink Node

- ▶ Automatic registration of new nodes without complex configuration
- ▶ Dispatches commands based on the received data
- ▶ Failure detection of sensors/actuators
- ▶ Saves useful information in a log server via serial port
- ▶ Ignores not allowed nodes



Sink Node



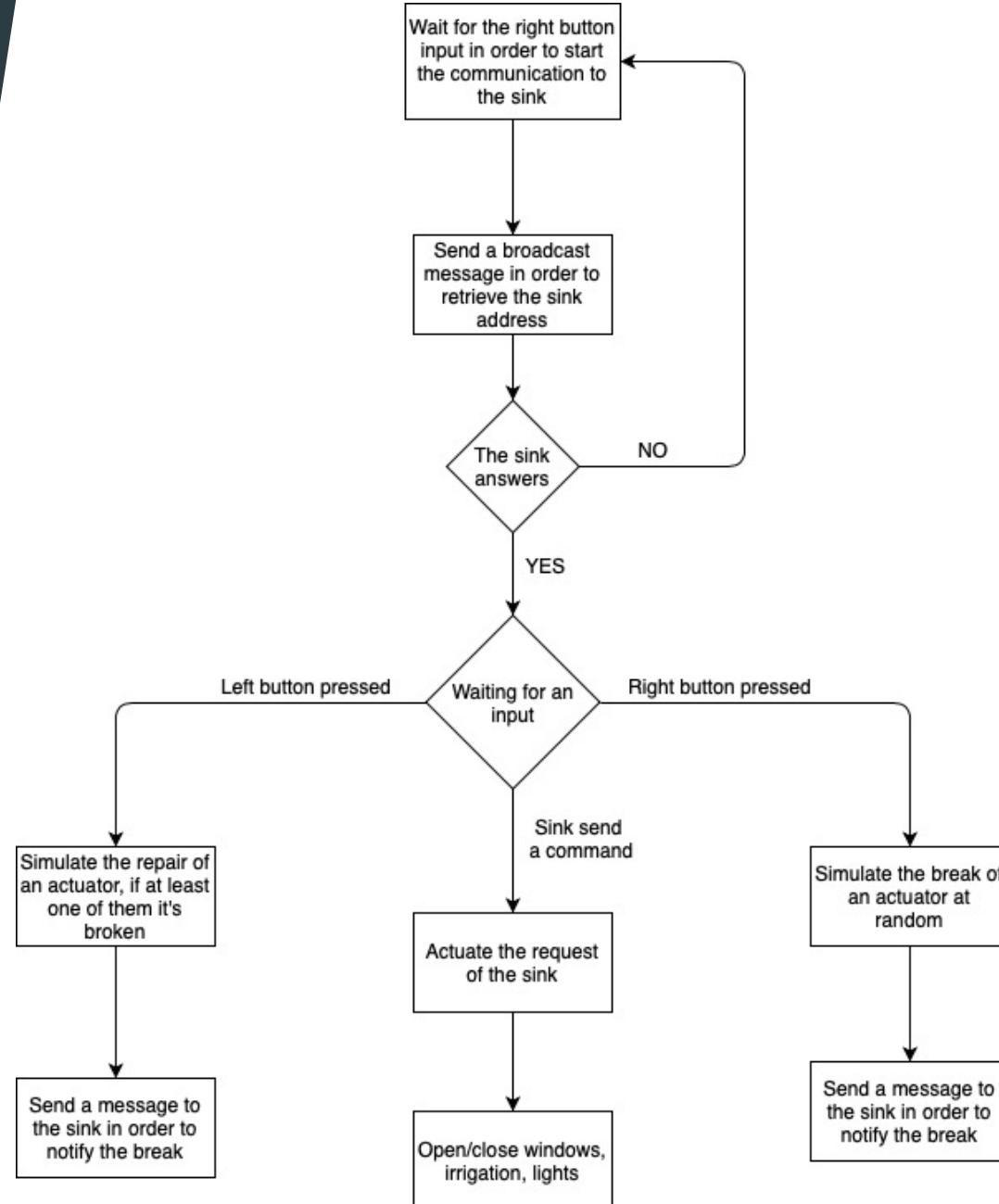


Actuator Node

- ▶ Has 3 kinds of actuators: windows, lights, irrigation
- ▶ The Sink Node can require the activation or the deactivation of the actuators
- ▶ The Actuator Node carry out the requests
- ▶ An actuator can break, the node simulate the break with the right button press
- ▶ Same for the case of a break, the node can simulate the human intervention for the repair, with the left button press
- ▶ Sends acknowledgement to the sink node at programmable time interval in order to spot malfunctions

Actuator Node

- ▶ High temperature -> Open Windows
- ▶ Low temperature -> Close Windows
- ▶ Low Humidity -> Open Irrigation
- ▶ High Humidity -> Close Irrigation
- ▶ High Dark -> Turn on Lights
- ▶ Low Dark -> Turn off Lights





Future Implementations

- ▶ Security: adding an advanced encryption level would be a good solution for protecting the communication against intruders
- ▶ Acknowledgements could be used to monitor nodes availability. Not feasible with “nullnet” MAC level
- ▶ Ability to turn on/off the radio in order to reduce power consumption
- ▶ Integration with a mobile application
- ▶ Remotely programmable Sink Node

DEMO

- 1) Actuator registration
- 2) Actuator notifies failures and repairs
- 3) Sensor Node registration
- 4) Usual functioning
- 5) Sensor Node sends anomalous data -> Sink does not sends the action to the actuator
- 6) Actuator turns off and Sink deregister it. Sensor Node sends data, but Sink doesn't take it into account.
- 7) Reject messages from non-registered nodes.