

Conceptual Design

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1 Introduction

This project will build upon a previous ECE 492 project *FPGA Enhanced Wireless Sensor Node for IoT Applications*. The previous project constructed a motion-triggered wireless sensor node that takes snapshots and sends them over ZigBee to a gateway device. The gateway then sends the image to a Dropbox cloud. This entire process was enhanced by elliptic curve cryptography which was implemented using an Actel Igloo Nano FPGA.

2 Conceptual Design

2.1 Application

2.1.1 Camera Module

- The camera being used is the ArduCAM v5 5MP camera with night-vision capability (\$21).
- The camera module will be controlled by the MSP430 through I^2C for instructions, and SPI for the images.

2.1.2 Android Development

- The Android app is used to receive photos via the Dropbox cloud from the gateway.
- The app will allow the user to manually request a snapshot.
- The app will setup a private connection via ECC, and allow the user to update the private key of the user.
- The app will be updated to deliver OTA updates via the dropbox cloud.

2.2 Dropbox Cloud

- Used to store updates and photos, as per the user's request.

2.3 Gateway

- Uses a BeagleBone Black to connect the node to the Dropbox cloud.
- Communicates to the network via Ethernet, which is secured by transport layer security.
- Communicates with the node via the ZigBee protocol, which is secured through AES.

2.4 Node

2.4.1 FPGA

- The Actel Igloo Nano will be used for securing the user's phone to the node.
- The FPGA will use elliptic curve cryptography, which uses smaller private keys than alternatives, allowing for more efficient use of memory.

2.4.2 MSP432

- Used as a controller for the FPGA, XBee, ArduCAM, and PIR Motion Sensor.
- The MSP432 will be initialized by the motion sensor or user input, and send a signal to the ArduCAM to take a snapshot.
- The MSP432 will receive the snapshot in JPEG format via SPI, and transmit the image to the XBee via the UART protocol.
- The MSP432 will use the key generated by the FPGA to secure this communication with the user.

Schematic

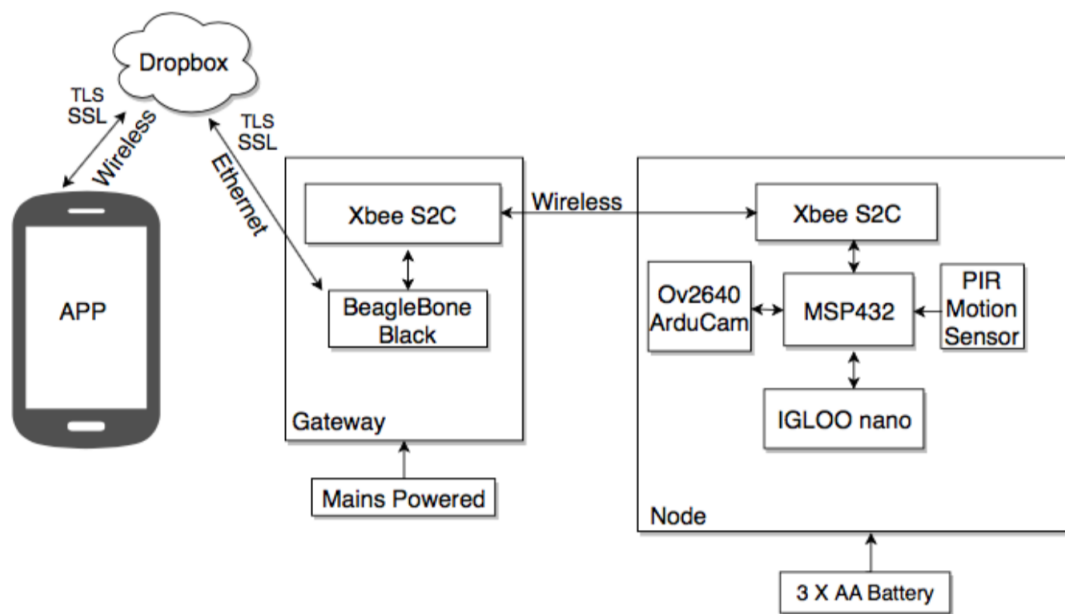


Figure 1: Top Level Schematic

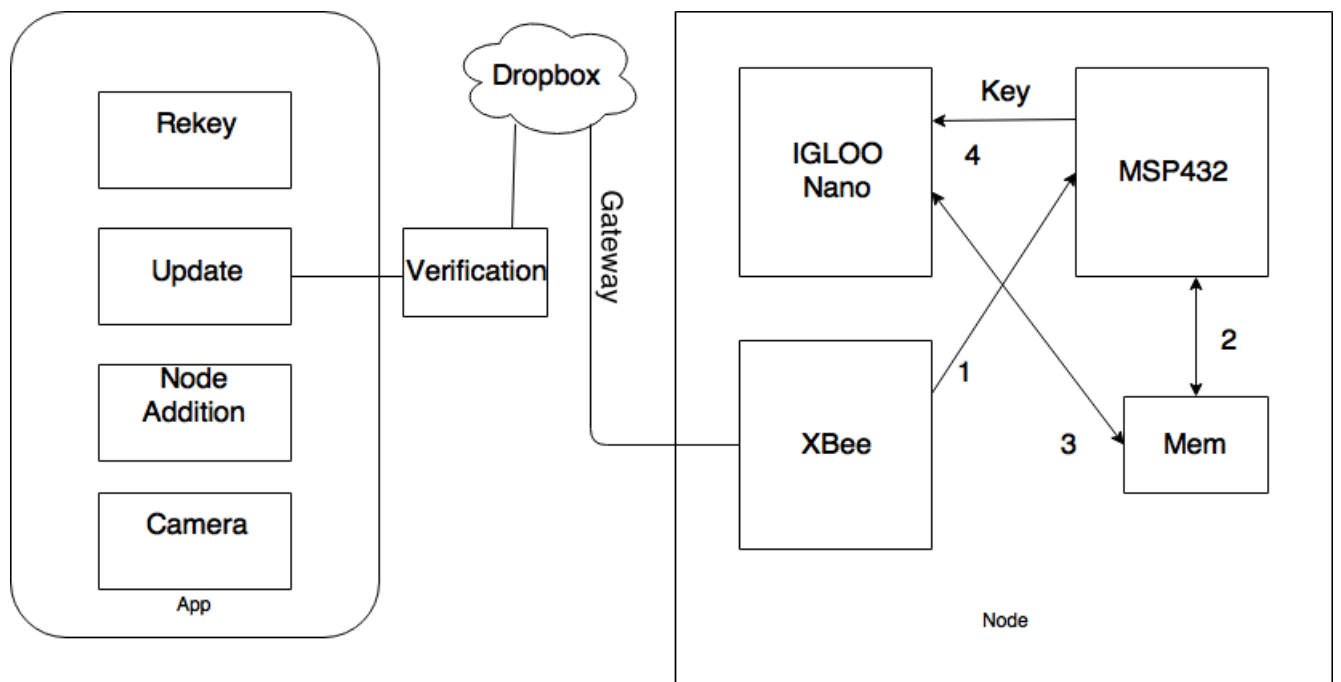


Figure 2: Top Level Diagram