

# Zigbee-to-IP application development

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**Abstract**—This is a technical report on a Zigbee-to-IP application for playing pingpong.

## I. INTRODUCTION

Zigbee is a wireless protocol providing a low-cost low-energy low-distance alternative for the WiFi technology. It was developed for the needs of exchanging small amounts of data, like the data collected from the sensors.

## II. SETUP OF THE SYSTEM

The small-scale wireless network consists of one stationary node and at least one mobile node acting as a pingpong racket. In this project two types of Arduino boards were used. Arduino Uno [1] for the mobile station and Arduino Ethernet [2] for the stationary one. The Arduino mobile station attached with a 2/3 accelerometer sensor TinkerKit[3] based on the tilt data sends commands to the stationary node over the Zigbee network. To build the Zigbee network we use Xbee RF modules[4]. The stationary node gathers information from all mobile stations and sends it to the specific computer in local area network. This computer performs all the necessary computations and draws the screen rendering correct positions of the rackets and the ball as presented at Fig. 1. In a scheme with one mobile node the second racket can be controlled by PC keyboard or by a special algorithm.

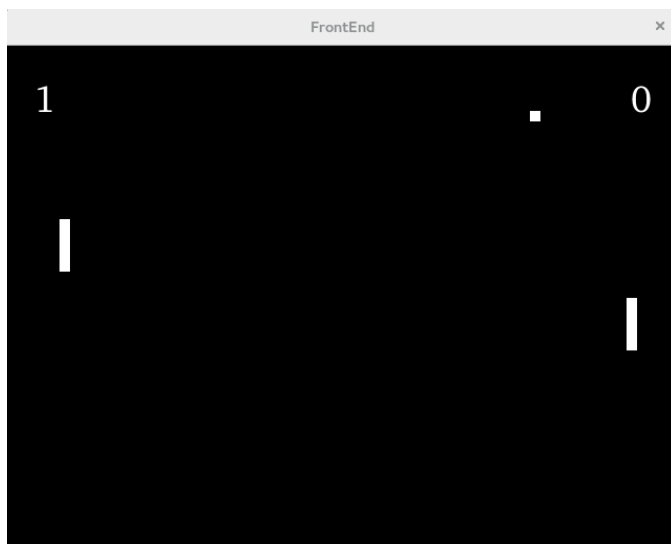


Fig. 1. Applications frontend with two paddles, player scores and the ball

## III. DETAILS OF THE SETUP

To create Zigbee network we first have to program Xbee devices. It can be done by connecting to these devices with

a terminal and accessing internals with modem AT command set. For the simplicity we used only one mobile node for this project, thus it is possible to enter addresses of both nodes (i.e. mobile and stationary ones) in the destination field of both modules.

The function of the mobile node is to collect the sensor data, filter it based on the threshold values and send it to the stationary node. The stationary node listens to this data and forwards it to the computer if it has not been corrupted by the noise. The connection with the node is established via UDP protocol and the stationary nodes acts as a server. It listens if there is someone in the network (LAN) willing to get the data from mobile nodes. If there is, the server passes the data down the wires. This strategy reduces the server activity. The UDP protocol is used since the application requires high throughput and is not dependent on any of TCP features.

The computer acting as a client asks the server for some data to draw on the screen. At the same time it evaluates the position of the ball and rackets, the game appearance and the score. Additionally it could provide logic for keyboard input and artificial enemy.

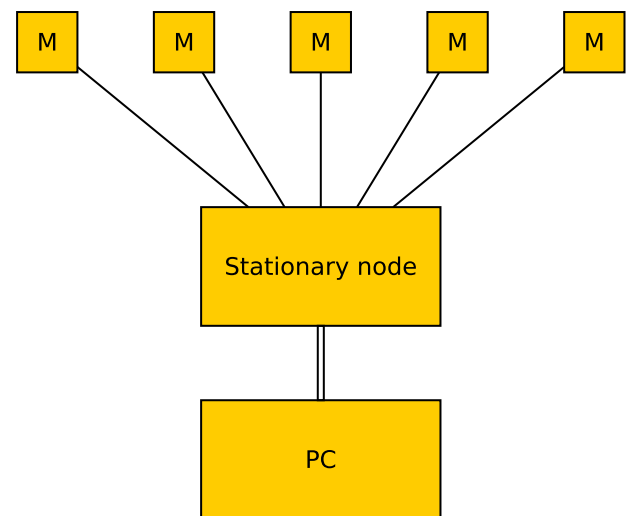


Fig. 2. The scaling prospect. The letter 'M' represents mobile nodes

## IV. PROSPECTS

The application could be scaled to support several players as presented on Fig. 2. For that purpose we would have to implement some of the band division techniques for multiple access such as TDMA, FDMA, or CDMA. Since the same screen is shared between all the players it is no use to intensively increase player capacity. The limitation of six

players seems reasonable. The stationary node would have to iterate through all the clients, accumulate their data in one current state message and send it to the PC to calculate current positions and perform visualization.

## V. CONCLUSION

As demonstrated in this paper the Zigbee technology is a fine alternative to WiFi. And it should be considered for use when some low distance low energy and low cost network is designed.

## REFERENCES

- [1] <https://www.arduino.cc/en/Main/ArduinoBoardUno>
- [2] <https://www.arduino.cc/en/Main/ArduinoBoardEthernet>
- [3] <http://www.mouser.com/catalog/specsheets/TinkerKit2-3AxisAccelerometer.pdf>
- [4] <https://www.sparkfun.com/datasheets/Wireless/Zigbee/XBee-Datasheet.pdf>