

Design a Wireless Lab Exercise for ECE 4760

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Introduction

The goal of this project is to develop a lab exercise for ECE 4760 involving wireless communication between two micro-controllers. The lab exercise will give students experience with using wireless transceivers and teaches them how to add wireless communication capabilities to the electronic systems that they design. Students can build on what they have learnt in this lab to explore interesting applications involving wireless communication in their final design project, where students design and implement a microcontroller project of their choosing.

Hardware

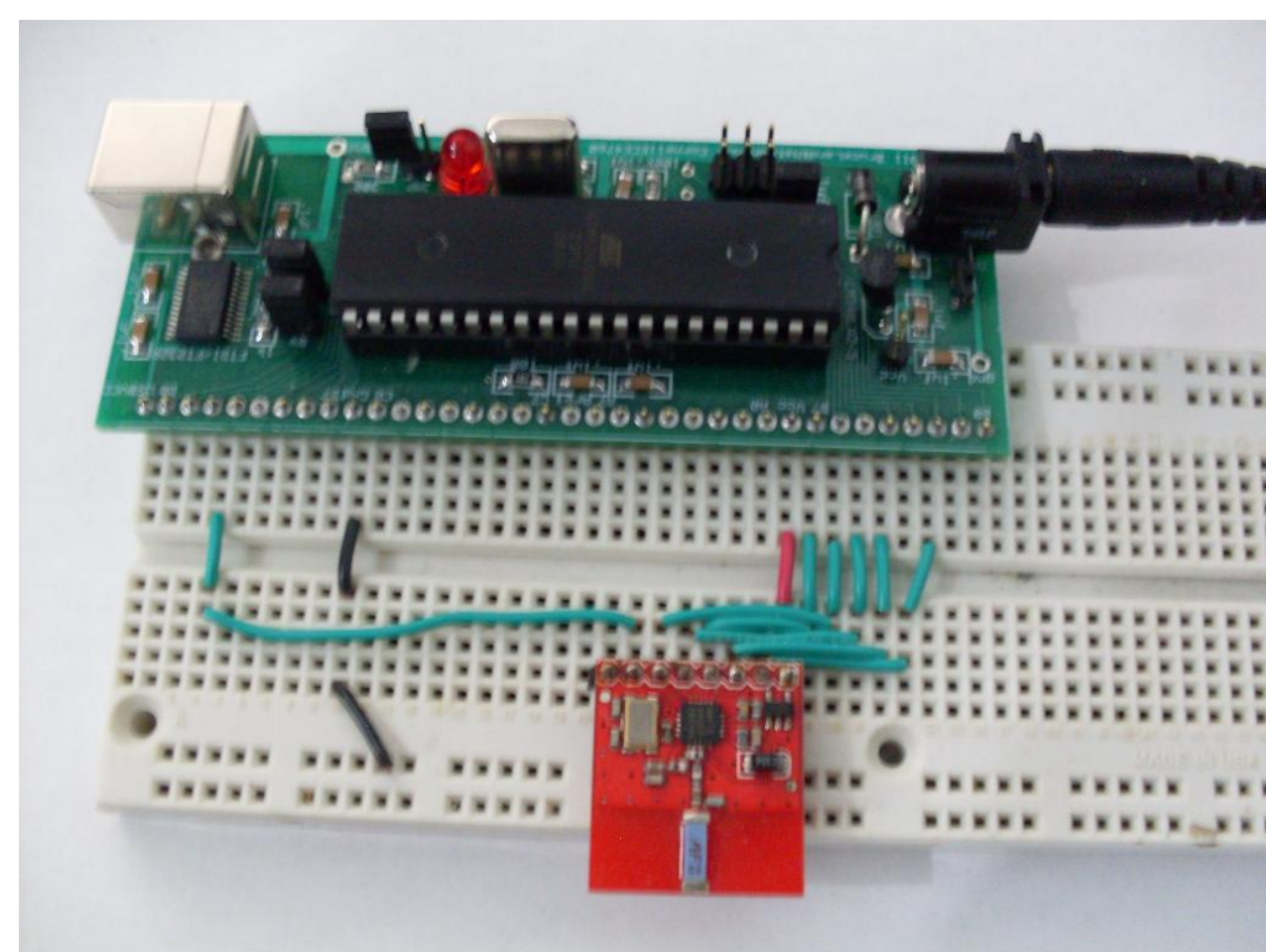


Fig 1. ATmega644 and NRF24L01+

The Atmel ATmega644 and Nordic NRF24L01+ wireless transceiver are used for the lab. The NRF24L01+ operates in the 2.4 GHz band and has an air-data rate of up to 2 Mbps.

Interface between microcontroller and transceiver

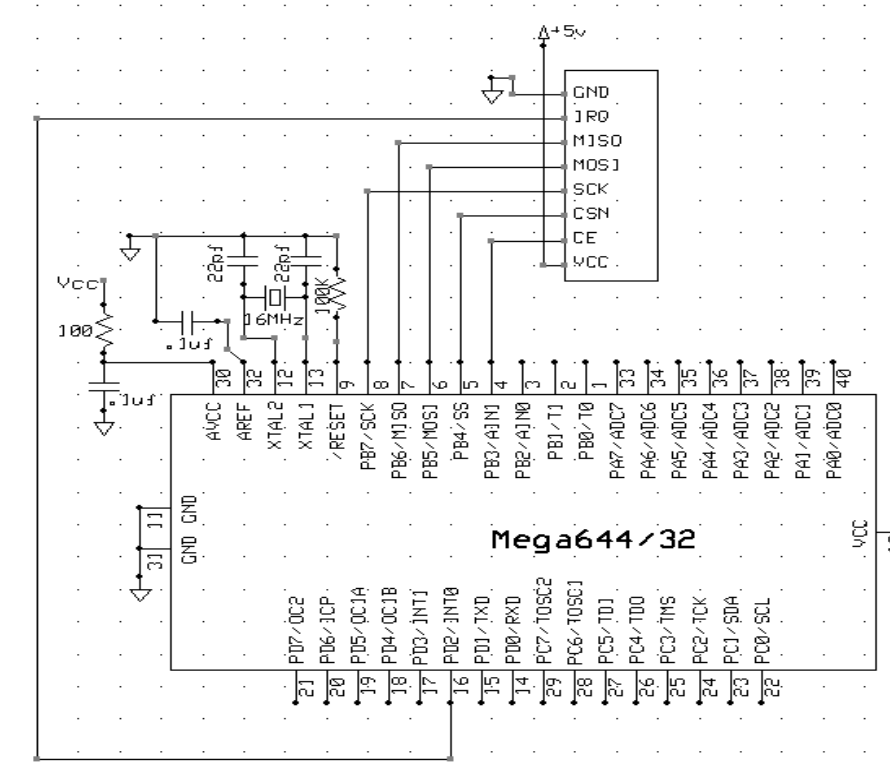


Fig 2. Connections between mega644 and NRF24L01+

The transceiver communicates with the microcontroller via a serial peripheral interface. In this project, drivers were written for the microcontroller to use in controlling the transceiver. The drivers provide functions that can be called by other programs to send and receive using the transceiver.

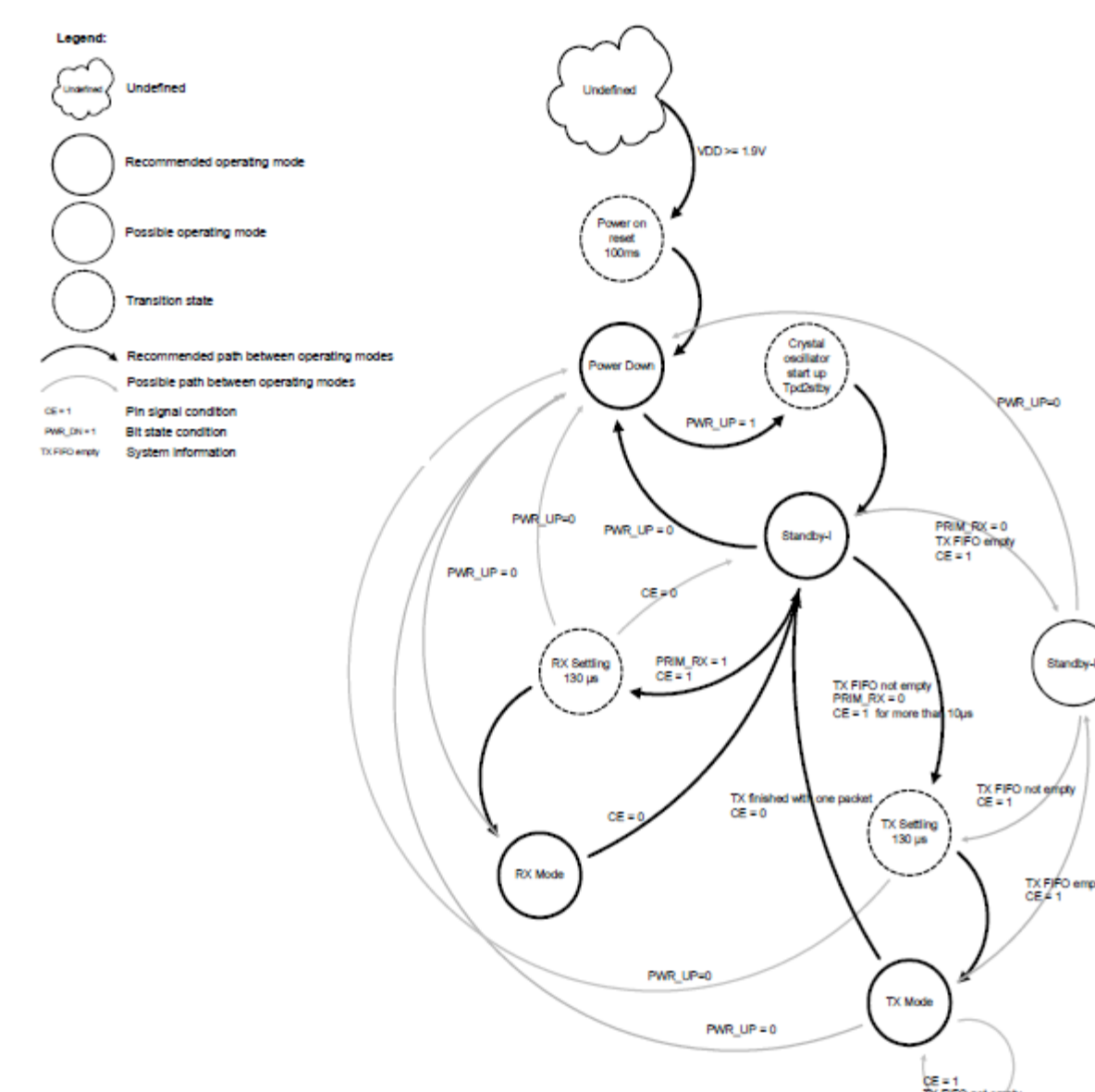
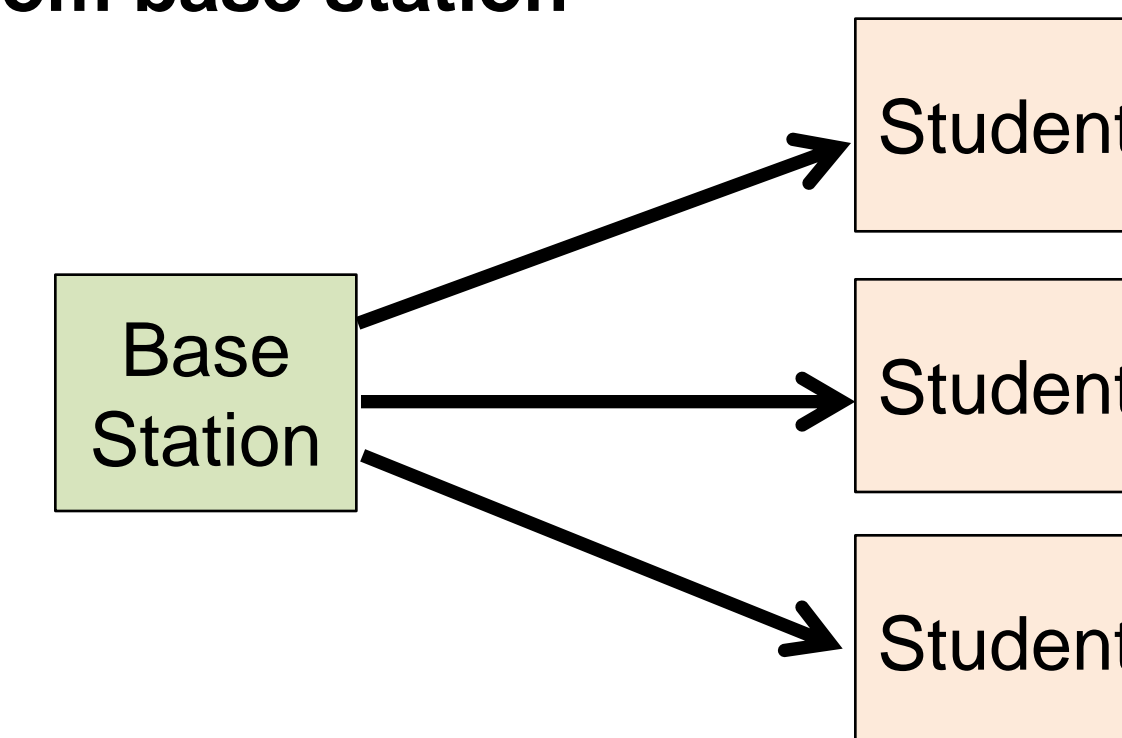


Fig 3. State diagram of the NRF24L01+

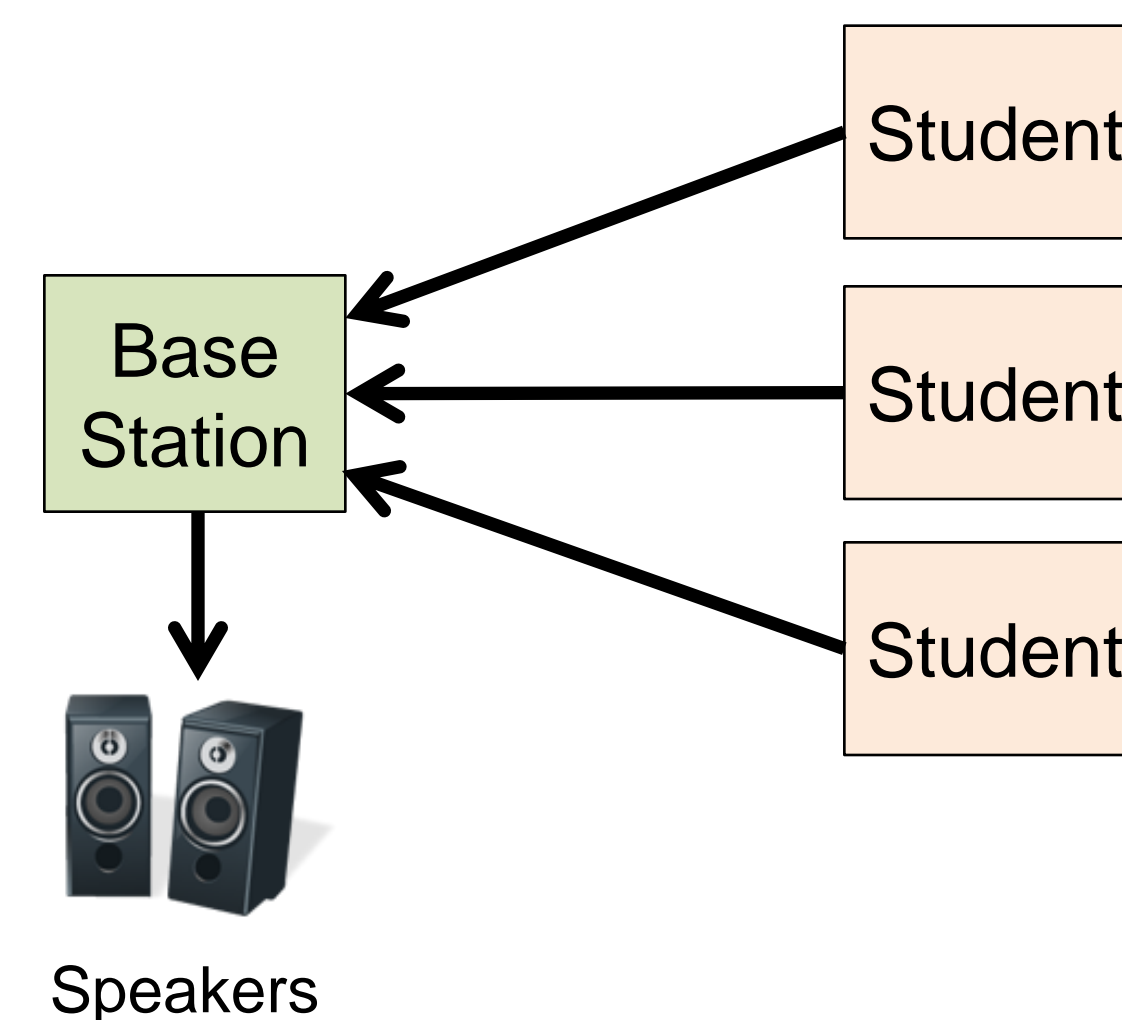
Structure of lab exercises

Part 1: Students receive broadcast from base station



This provides a relatively foolproof way for students to test that they have connected the hardware correctly.

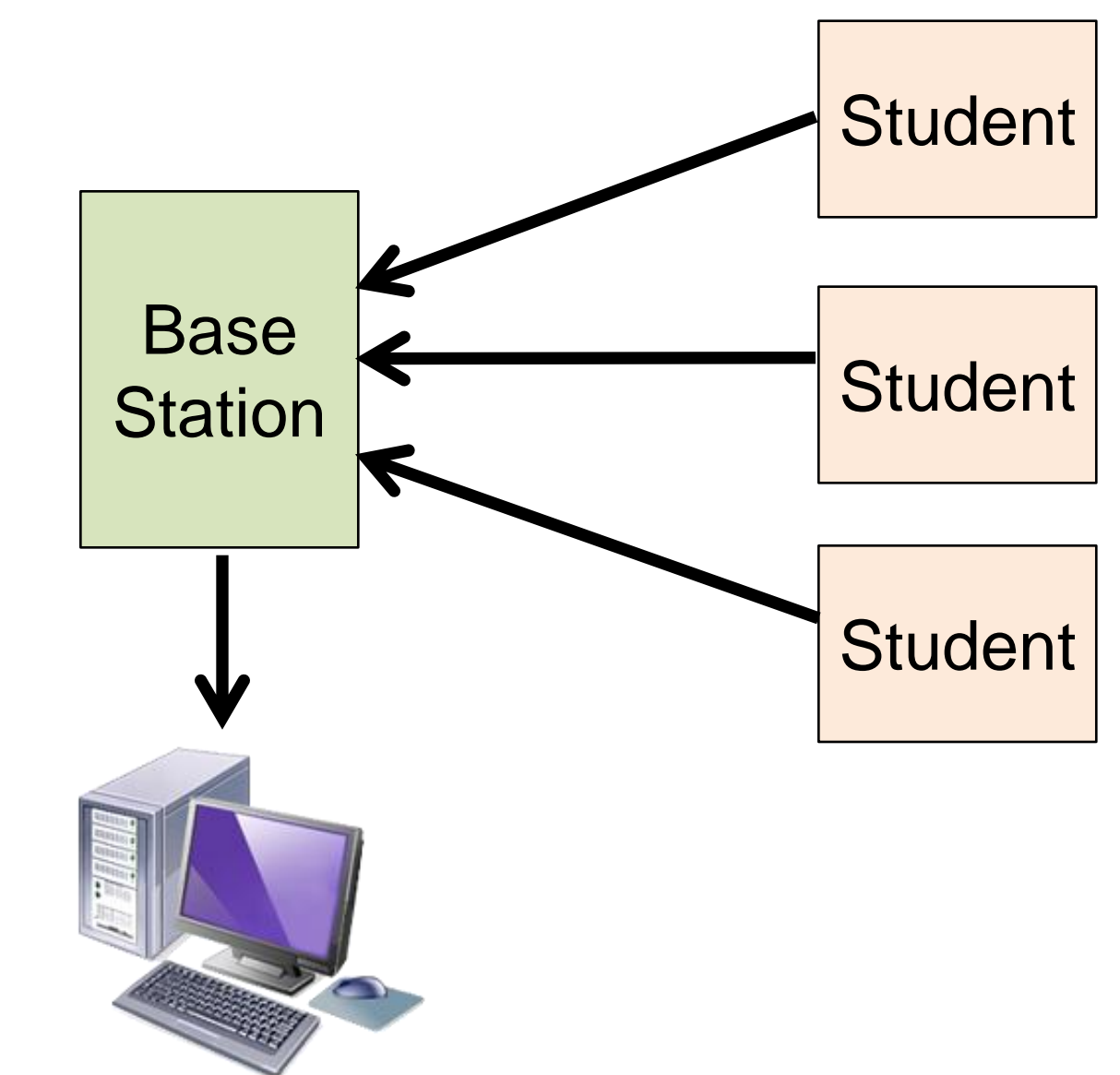
Part 2: Students synthesize a sound signal through direct digital synthesis and sends it to base station wirelessly



This can be an extension to the existing audio sequencer/synthesis lab. Given that wireless communication can be unpredictable and easily disrupted when

many students are transmitting and receiving (such as multiple students mistakenly using the same address or transmitting to the wrong target), adding it as small extension to another lab could be a low risk way of testing a deployment of the wireless lab exercise.

Part 3: Wireless multiplayer game



Serial connection to computer

The framework of this lab exercise can be applied to applications where a central base station wirelessly receives and sends data to multiple microcontroller based systems. For example, microcontroller based devices can be deployed in the field to gather data, which they transmit to the base station which passes it to a computer for logging.