

Project Proposal

zPlayer

02/16/2010

Michael Nazareno, xxx@gwmail.gwu.edu*Project Abstract*

The zPlayer is a digital music player based on the ZiLOG ZNEO Z16F flash microcontroller. The device (base unit) reads digital music files stored on a Secure Digital (SD) card and plays them for output through an audio jack. zPlayer will support the MP3 format, but other formats may be supported as well. The user interface of the zPlayer consists of a separate battery-powered remote unit which communicates with the base station using the ZigBee communication protocol. zPlayer controls such as play/pause, previous/next, and volume are provided to the zPlayer using motion sensing accelerometers and a minimal set of switches. In addition, an LCD screen on the remote unit displays convenient zPlayer status information such as the current song and time.

Strategy

Platform: ZiLOG ZNEO Z16F Flash Microcontroller

Capabilities: GPIO, timers, interrupts, DAC, ZigBee

External: SD card reader, audio jack, DAC, switches, accelerometers, LCD screen, battery, ZigBee modules

Evaluations: design of the remote unit to be handheld, accelerometer support, data rate and protocol of the ZigBee modules, user interface design, digital audio format support

Software Modules: SD reader, digital format (MP3) decode, input handling, display handling, playlist handling

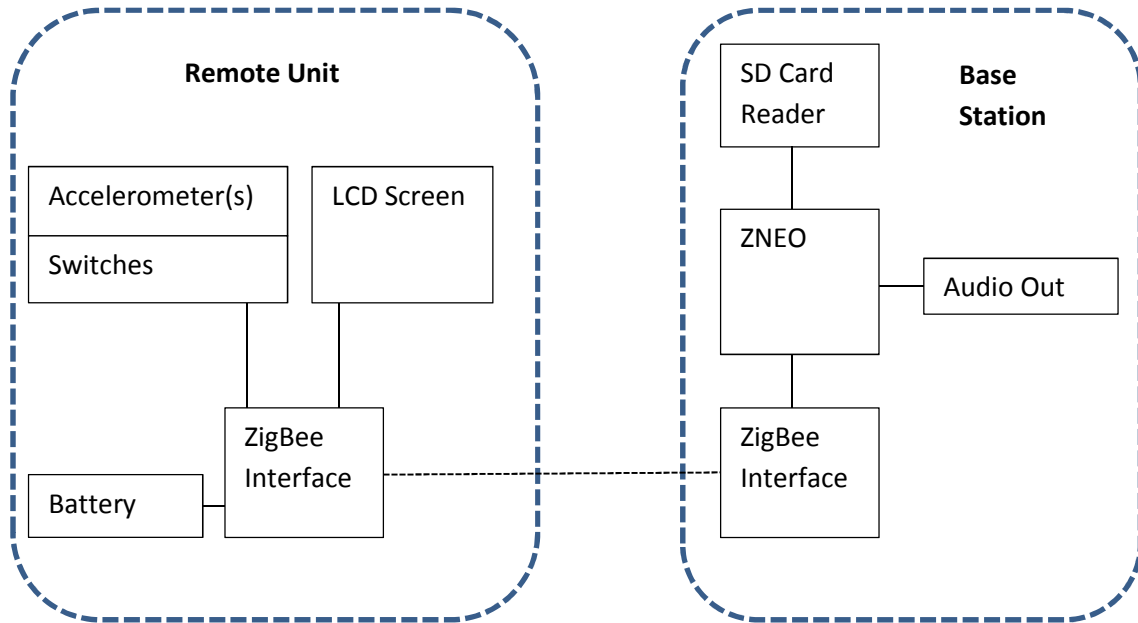


Figure 1 – zPlayer Preliminary Hardware Design

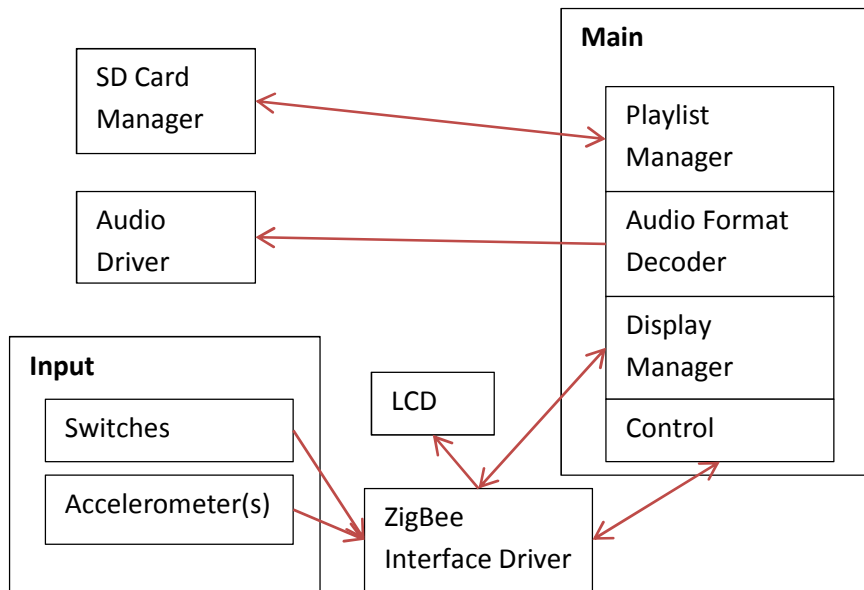


Figure 2 – zPlayer Preliminary Software Block Diagram

Unknowns

Power consumption of the remote unit is unknown at this time and will depend on the components involved. I am unfamiliar with a lot of the components required (SD card reader, ZigBee, accelerometers), so I will need to familiarize myself with them. The remote unit might even require a microcontroller of its own, in which case the zPlayer becomes two devices interfacing with each other. I need to research how ZigBee communication is done, but I have read that the data rate can approach 250kbps, which should be more than enough for the amount of control data being exchanged.

Originally my idea was to output audio to the remote unit, but under there is not enough bandwidth under the ZigBee protocol without deteriorating the quality. Bluetooth would work, but my preference is to become familiar with ZigBee; it is also low-power.

I am unsure of the memory and processing requirements involved with decoding an audio format. I am also not sure what is needed to actually output through an audio jack and hear via a speaker or headset.

The SD card will have a File Allocation Table (FAT) file system, which I will need to familiarize myself with as well.

Implementation Plan

Development is based on the ZiLOG ZNEO Z16F Flash Microcontroller Contest Kit using the ZiLOG Development Studio. The first step is the research and acquisition of all components: SD card reader, LCD display, switches, accelerometer, audio jack, battery pack, and the ZigBee module. The second step, maybe with a limited user interface with the on-board switches, is to get reading to and writing from the SD card working using the FAT file system. The next step will be implementing MP3 decoding and playback through the audio jack for speakers or a headset, enough for simple playback of an individual file without advanced playlist controls. Next will be the design and implementation of the ZigBee-based remote control unit, utilizing the advanced accelerometer and switch controls (to be determined), LCD display, and battery pack (enough for demonstration purposes). A control communication protocol will need to be established as well. This may require development for the remote unit's microcontroller. Minimum user controls for this design are play/pause/stop, previous/next, and volume up/down. Some sort of playlist synchronization mechanism also needs to occur whenever an SD card is inserted. The last step, which for debugging purposes may be in conjunction to previous steps, would be the development of the LCD display driver. Extra steps would involve improving the functionality of the device, such as

support for additional formats, more playback modes (shuffle and random modes), and additional user controls (seeking within a track, mute).

Resources

Zilog ZNEO Z16F Flash Microcontroller Contest Kit – provided by university

SD card reader – provided by university, else need to buy

LCD display – provided by university, else need to buy

ZigBee module – need to buy

Accelerometers – need to buy

Switches – need to buy

Audio Jack – need to buy

Battery Pack – need to buy