Ocarina Home Automation

Oracle of Seniors

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# Project Abstract

Home automation or *domotics* is currently experiencing a large growth in the market

share for creative IoT applications. Our idea is to have a central control unit that will be listening for successive notes i.e. (a known tune acting as a passcode) that will trigger certain peripherals e.g. a motor to turn a fan, a water dispenser, or a Bluetooth enabled device. NOTE there are many possibilities with a configuration such as this one. The main processing will be to parse the instrument for the notes and be able to filter, window, and analyze the fundamental frequency of that tone. There will be an LCD display to monitor the current status of the appliances that can be controlled.

# Project Features/Objectives

The Home Automation system will have the following components:

* Microphone Audio Capture and Signal Conditioning
* ADC Sampling of Audio Signal
* Audio Processing using TI TMS320F28335 DSP
* Motor Driver and Control
* Solenoid Driver and Control
* Solenoid Valve or Water Pump Driver and Control
* LED Control
* Environment Sensing (Light and Temperature)
* LCD Display
* Power Design for all Digital and Analog Circuits

## Software Objectives

To accomplish the task of audio processing and task triggering, we will base our code around the TI-RTOS kernel. This will make scheduling of tasks simpler and allow for real time control of hardware peripherals.

## Audio Processing Objectives

The TI DSP will be processing a conditioned audio signal in real time using FFTs to determine the maximum frequency in the spectrum. It will then use pattern detection to determine if a specific set of frequencies were being played contiguously (i.e. A song). If a specific “song” is detected, it will trigger a designated home automation task.

# Concept/Technology Selection

‘Ocarina home automation’ makes for a simple yet charismatic design that can be applied to a myriad of home appliances. Current ideas on the market are the Amazon Echo, Google Home, and Apple’s Siri, however it is important to mention that they require proprietary hardware and the speech recognition is not optimized for all languages, our idea simply requires that you play a flute.

A dedicated DSP will be used for audio processing and control of all peripherals. The TI TMS320F28335 DSP is a suitable processor for this application. It contains a C2000 150MHz core and a dedicated Floating Point Unit. It has plenty of peripherals such as ADC, McBSP, SPI, I2C, PWM, and many GPIO pins. These extra peripherals allow us to dedicate specific pins to the various home automation tasks.

Real Time Operating Systems (RTOS) allow users to take advantage of a scheduler and basic thread synchronization techniques such as HWI, SWI, and Semaphores to implement their applications. This makes it simple for the user to schedule various tasks and functions based on priority and maintain real time characteristics. TI offers the TI-RTOS kernel as a software solution for real time operating systems on their devices, such as the TMS320F28335 DSP. This software package contains libraries and APIs which the user can use to develop their code for RTOS on the target hardware. It allows the user to maintain control of all hardware peripherals. We will use TI-RTOS in our project because it will allow us to build our system on top of a RTOS and aid us in function scheduling during the software development part of our project.

# Flowcharts & Diagrams

