# Microprocessor

### Technology and Technical approach Considerations

The microprocessor is the brain of the steam valve controller as well as the user interface unit. Because two different products are needed with differing characteristics and levels of performance, two different microcontrollers will be needed. The user interface unit will require a microcontroller with one SPI for the LCD interface, one ADC for the temperature sensor, a UART for the wireless communication, and 5 general purpose input output pins for the 3 push buttons, one speaker, and one potential motion detector. This microcontroller needs to operate on 3.3 V technology or better. The steam valve controller unit will need to have one USART for the wireless communication, Ethernet port capability, and 3 GPIOs for a shaft encoder, the motor driver, and a speaker. This microcontroller can operate at various voltage technologies. Since this unit will be close to the steam pipes, the microcontroller will need to operate at around 100 degree Fahrenheit temperatures. We are searching for Atmel microcontrollers in order to save time with programming due to previous experience with Atmel. This will also save on cost since many ISU computer engineering labs have Atmel compatible programming devices and compilers.

### Testing requirements considerations

There are a number of tests that must be performed. The unit must be tested to ensure basic functionality and reliability. The most basic test would be to test pin functionality to ensure that the units perform the appropriate functions and have good signal integrity. The voltage rails need to be tested in order to ensure low ringing on the lines. The microcontroller’s operation needs to be tested at a wide range of temperatures in order to assure a reliable product. The signal communication lines need to be tested for reliability, with reliability being measured as the percentage of the transmitted bytes that were received correctly.

### Security considerations

The steam valve controller unit will contain microprocessor with Ethernet connectivity. It will be connected through the Iowa State University network. This can lead to security issues due to hacks and possible re-programming of the controller itself. If the culprit is skilled enough, they may even gain control of the temperature units throughout the building and may cause damage by controlling the DC motor. However, this has not happened to the current system. Since our system will be governed by the same individuals, Facilities Planning and Management, we do not expect any harm to occur to our unit or Iowa State University property.

### Safety considerations

The only safety consideration is microprocessor overheating. If the microprocessor becomes too hot, it may burn individuals, cause damage to the unit, and even cause a fire. This can be avoided by smart design. Our group is experienced enough with hardware to design around these issues. We will pay great attention to detail and follow through with the manufacturer recommendations.

## Summary

### User interface:

SPI - LCD

ADC – Temp Sens

2xUART – Wireless comm extra uart

10 GPIOs – 3 push buttons and one speaker and potential motion dect 5 extra gpios

### Controller unit:

2xUART – Wireless comm

Ethernet

8 GPIO – shaft encoder, motor driver, speaker, 5 extra gpios

### Atmel Microcontroller under consideration:

AT32UC3A0128

<http://www.atmel.com/dyn/products/devices.asp?family_id=607>

<http://www.mouser.com/ProductDetail/Atmel/AT32UC3A0128-ALUT/?qs=TKG%2fBBzsYfv3InFLZ%252bp4bw%3d%3d>