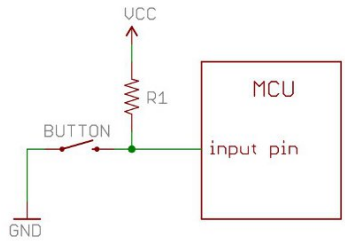

What is the most common issue with switch input systems that designers must address in their software?

A. short circuits
B. switch bounce
C. inadequate voltage
D. input pin malfunction
ANSWER: B
Switch bounce is a typical issue with switch input systems when the input pin reads the "bounces" in the voltage change every time the switch is changed. The common approach to such an issue is typically a "debounce" software to ignore the fluctuations.

Which of the following situations would using an analog pin be most suitable compared to a digital pin?

A. rotating a servo to an exact degree
B. lighting a series of LEDs
C. reading multiple switches with one pin
D. reading signals from input buttons
ANSWER: C
The key difference between analog and digital pins is the analog pin's ability to read the analog values of input voltages. In this case, a typical parallel circuit of multiple switches can be read through the different total voltages of the circuit. Though the Arduino typically utilizes PWM to create pseudo analog pins the usages are still the same.

What is the unit of measurement associated with the concept behind the ability to display updating screens on 8x8 LED matrices and larger, more advanced LED displays?

A. Henry, scan lines
B. Farad, screen update rates
C. Ohms, update lines
D. Hertz, refresh rates
ANSWER: D
The refreshing of screens through iterating individual scan lines creates the smooth illusion of updating displays in LED matrices. The rate at which the display refreshes or refresh rate is typically described with the unit Hertz (Hz).

What is the most applicable simple Machine Learning algorithm to predict the amount of rainfall based on previous data on levels of humidity and inches of rainfall? And why would this algorithm be the most appropriate?

A. Linear regression model, minimum description length principle
B. Linear regression model, information entropy
C. Decision trees, minimum description length principle
D. Decision trees, information entropy
ANSWER: A
According to the minimum description length principle, the fitting simplest model will generate better results at greater efficiency. Therefore a Linear regression model using data points of humidity and inches of rainfall would be the most appropriate.

According to Claude E. Shannon's concept of information entropy, what is the most accurate description of the relationship between entropy, uncertainty, predictability, and information content in a Machine Learning algorithm?

A. less uncertainty will create more entropy
B. less uncertainty will make results more predictable
C. less entropy means less information content
D. greater entropy will make results more predictable
ANSWER: C
Shannon's information entropy states the following relationships, less uncertainty is measured as less entropy, but also results in greater predictability and less overall information content available. Therefore, the only accurate description of information entropy is "less entropy means less information content".

When met with an issue in an electronics project, according to the suggestions from the course, how would you get around debugging the issue?

EXAMPLE SOLUTION:

Starting with physical electrical elements, we first check if components or connectors are connected backwards are wrongly. Next we check if the wires are where they should be, and whether power is able to run through them. Here we can utilize multimeter, scopes, logic probes, or debugging LEDs to check whether power is running through the circuit correctly. Moving on to components of the circuit, we can check if there are any culprits of the issue. Such culprits may be drawing too much power or current, or may potentially be broken or burnt out. Similar tools from before can also be used here to check whether if signals are going through correctly. After checking major points of potential problems, we can conduct thorough searches of solder connections, wire connections, and potential damages during the debugging process.

However if the process above is unable to determine an issue we can create test frameworks to isolate and debug the entire circuit stop-by-stop. Whether that be isolating specific gadget function groups or circuits, simplifying and isolating bugs of the entire complex system can prove great clarity. Breaking it further down if this still doesn't provide a solution, we can list individual components and check them in isolation with simple experiements and tests with their own seperate systems.

Lastly, if there is a software component, software debugging may also be required. Utilizing a componentation of system printf() debugging checkpoints throughout your code and also debugging LEDs in your circuit further issues in the software can be isolated and solves individualy.

From the research papers in class, explain in depth the different ways to conduct non-invasive water use measurements? Additionally, explore how might other applications of other gadgets can be utilized in sensing domestic water use.

EXAMPLE SOLUTION:

One of the first papers explains the usage of simple microphone sensors on water pipe in the basements to sense water usage. Not only was the sensors capable determining the flow of water through pipe sounds with somewhat accuracy but also computational was able to determine the usage of water for seperate water systems around the house. At a very low intervention, by computing over some window of time the frequences of water flow in the pipes were also able to

be seperated into frequences synomous with different water usages around the house, giving the sensor the ability to determine mutiple sources of water usage with some accuracy.

As for the other application the use of pressure sensors in the same application uncovers the effectivity of different applied sensors. Interestingly it begins the dialogue of whether an application of a device is the most effective way to measure a variable or solve an issue. It reminds me about the conversations about home speaker assistants where some may argue their voice controls aren't more efficient in temperature control than manual counterparts. Similarly though some sensors may be more expensive than others and have more applications available but there is discourse about the needs and issues of the user needed to be met.

In this way, I wonder if it is possible to also utilize humidity sensors in areas of water usage to determine the amount of water used at each of these locations. Whether this use of sensors will prove to generate more accurate readings is in question but it may also prove to be accurate in determining other variables like heat of the water and strength of the exiting water flow.