R·I·T

P19345: Model Railroad Control Panel Project
MSD II Problem Tracking

Problem Number	Identifying & Selecting Problem PSP 1	Analyzing Problem PSP 2	Generating Potential Solutions PSP 3	Selecting & Planning Solution PSP 4	Implementing Solution PSP 5	Evaluating Solution PSP 6
	R1	R2	R3	Y4	Y5	G6
1	Raspberry Pis do not have enough memory space to store the needed information for the project	Determine the amount of memory space needed for the overall project	- Look at different memory cards available for the Raspberry Pis - Redesign data structures used for storing information	- Could choose the device that provides a high storage capacity with little cost - Could go with a more efficient data strucure implementation that uses less storage	- Looked at different memory cards available for the Raspberry Pis	- This is a sufficient solution, as it limits the team as to how big our data structures should be, how big our code gets, how much data we send throughout the network, and how many SD cards with some amount of storage the customer needs to buy to get the system to work
2	System response time to input is too slow	Isolate individual actors within the system and collect timing information to evaluate slowest component. Network topology can be tested in different configurations. The use of timer functions can help with determining when a system response is slow.	- Once identified, redesign implementation of the slowest component, and others that are affected with the redesign - Optimize the implementation to provide faster response times - Look into design of the network topology of the Pis	- Could choose the implementation that is more efficient and provides a faster response times - Could choose a different network topology design to implement that provides a faster response time	System design was built from original plans and tested.	Testing of system response time was completed via MSD Test Plan methods- all testing was satisfactory. More tesing will be completed when more components are added to the overall system
3	Serial communication integration does not function properly	The network topology could cause issues with connections between Pis. Specific GPIO pins may not be providing / receiving signals. Initiation of the GPIO communication on a Pi may be set up incorrectly.	- Look into the design of the network topology of the Pis - Include different hardware components to accomodate for signals not communcated to the system - Redesign initiation code implemented to start GPIO communication on the Pis	- Could choose a different network topology design to implement that provides a faster response time	TBD	TBD
4	A specific behavior does not happen after the associated action was performed	A connection was not done properly between either Pis, or between the Pis and its PCB. The wrong function was used triggered with performing the action. The correct function was triggered with the action, but it did not complete the entire function's behavior.	- Debug the function by either printing log statements, or putting "break points" in the code (if available) - Double check connections made with hardware - Look into initialization of code to make sure pins are initialized properly - Redesign code to implement function correctly - Redesign / Look into prioritizing of actions	- Could choose code implementation that is more efficient with handling actions triggering functions	- Printing out log statements in the code - Double checking connections made with hardware - mostly having another team member look at the connections to verify thy were done correctly	- Using log statements has been helpful in determining what data is being sent and just knowing where the code is when issues or bugs arise in the code. It also helps with letting the team know which step in the code the program is at during run time - Having other team members to make sure connections are done correctly has helped solve this problem many times successfully, as working on a task individually could make some people less likely to see simple mistakes
5	WiFi connection (RIT's network) is unstable	Communication with the Pis wirelessly does not happen at all or is unstable.	- Look into configuration of WiFi connection on Pis - Ask other students for help with connecting Pis to RIT's WiFi	- Could choose the WiFi configuration that allows for a stable WiFi connection on the Pi	- Looked up online how to get WiFi connection setup on the Pis. Steps for setup to connecting to RIT's WiFi is provided in a document under <general MSD team drive>/software/Set Up WiFi for Raspberry Pi	WiFi connection is setup on most Pi devices, except for one Pi0. Not sure about this issue, but with another Pi0 already connected to the WiFi, testing with the single Pi0 has been sufficient so far. Will get the WiFi setup for the remaining Pi0 as it will be used for testing with multiple Pi0s attempting communicaiton with a single Pi3.

6	Power supply could be noisy	Because our 5V is generated from a 12V supply using a buck converter, the power being supplied to the RPi could be noisy	Add more filtering to 5V rail or buck to a slightly higher voltage than 5V, then use a LDO linear regulator with good PSRR to provide a stable 5V	Design for maximum dropout voltage of chosen LDO, then choose an appropriate resistor in the buck feedback circuitry to reach that voltage. Then, use the 5V generated by the LDO to provide a stable and clean 5V to the RPi	Modified schematic and board layout to accomodate a LDO linear regulator that can supply a suitable output current, modify feedback resistor in buck circuit, added some capacitance to input and output of regulator for stability	TBD - have an option on board to bypass the linear regulator if we find it is not necessary
7	5V could damage the RPi	With the exception of the 5V pins on the 40-pin header, the GPIO pins are only 3.3V tolerant, and voltages above that could damage the RPi	Could use another linear regulator (3.3V) to reduce the 5V we generate, or we could use the 3V3 generated by the RPi's own 5V to 3.3V regulator	Because of the relatively low currents that we will be using, we chose to connect directly to the 3.3V GPIO pin on the RPi, rather than generating another voltage	Changed all of our 5V supplies to the ICs we are using to 3.3V instead and checked the datasheets to make sure that this reduction in supply voltage would be acceptable	TBD - wouldn't want to try using 5V
8	Excessive input currents to GPIO pins on the RPi could be damaging	When using GPIOs as inputs, it would be possible to sink an excessive amount of current into the pins, which could damage the device. individual GPIO pin can only safely draw 16mA	Only practical solution is to add series resistors to limit current that could enter the RPi	Determine an appropriate resistor value to limit current - chose 4K7 resistors to limit current to less than 2 mA or 8mA at normal operation current	Modified schematic and adjusted the board layout to accomodate 6 extra resistors	TBD
9	5V linear regulator could be damaged if output voltage exceeds input voltage	Because there is somewhat considerable capacitance on the output of the 5V linear regulator, one could imagine a scenario where the input power was disconnected, and the output voltage remained close to 5V due to the external capacitance	Could add bleeder resistance to the 5V output, or could add a diode from output to input	Chose a diode connected from the output back to the input to waste less power	Modified schematic and board layout to include a diode connecting output and input of the 5V linear regulator	TBD
10	5V linear regulator could get hot during operation	Because a linear regulator operates on the principal of turning excess voltage into heat, recommand operation temperture is -40 - 150 C. one could image that it could get warm and increase voltage and current output that might damage other circuit	Could add a heatsink, or could add heatsinking to the board without adding extra money or space	Chose to add heatsinking to the PCB via the ground plane on the underside of the board	Placed linear regulator on underside of board with some solder mask removed so that the tab of the TO-220 linear regulator package (connected internally to device ground) could be soldered to the large ground plane that exists on the underside of the PCB	TBD - would like to measure the regulator's steady state temperature at some point