TAPS: Touch-Based Adaptive Predictive Screen

Problem Statement

Many touchscreen products are unable to adapt adequately to dynamic environmental changes, such as changes in light intensity and the introduction of vibration. These environmental factors introduce errors such as "false touches," which result in the trigger of unintended screen functionality. These touchscreen products go in hospital equipment, airplanes & jets, police cars, etc.

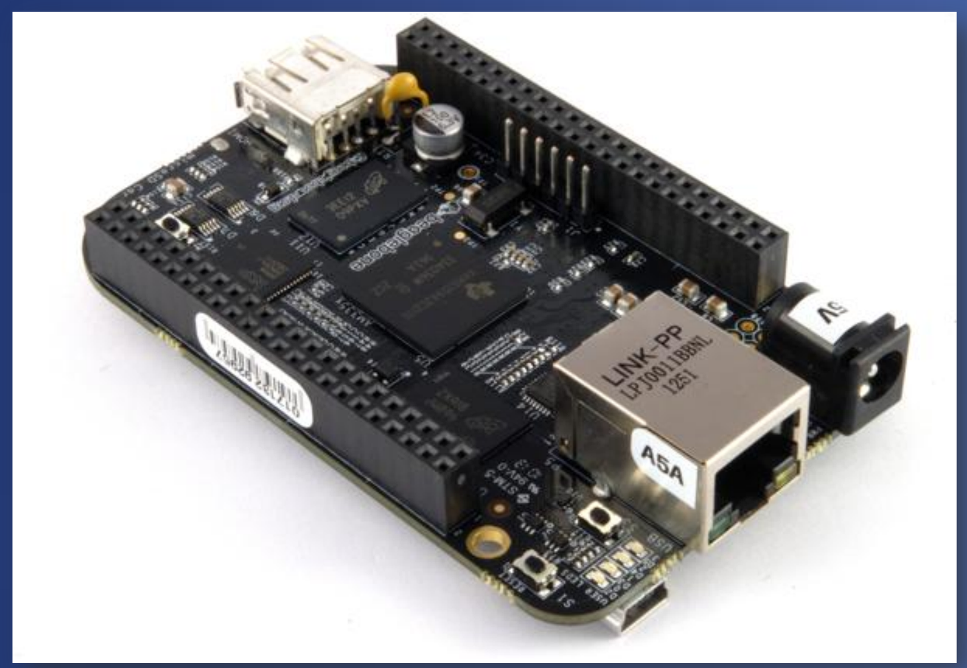
Esterline Touchscreen: enhanced to compensate for vibration and changes in light intensity.

Project Goal

The goal of this project is to develop enhancements for a touchscreen product. These enhancements enable the touchscreen to adapt dynamically to changes in light intensity and the introduction of vibration to the touchscreen system.

Project Sub Goals

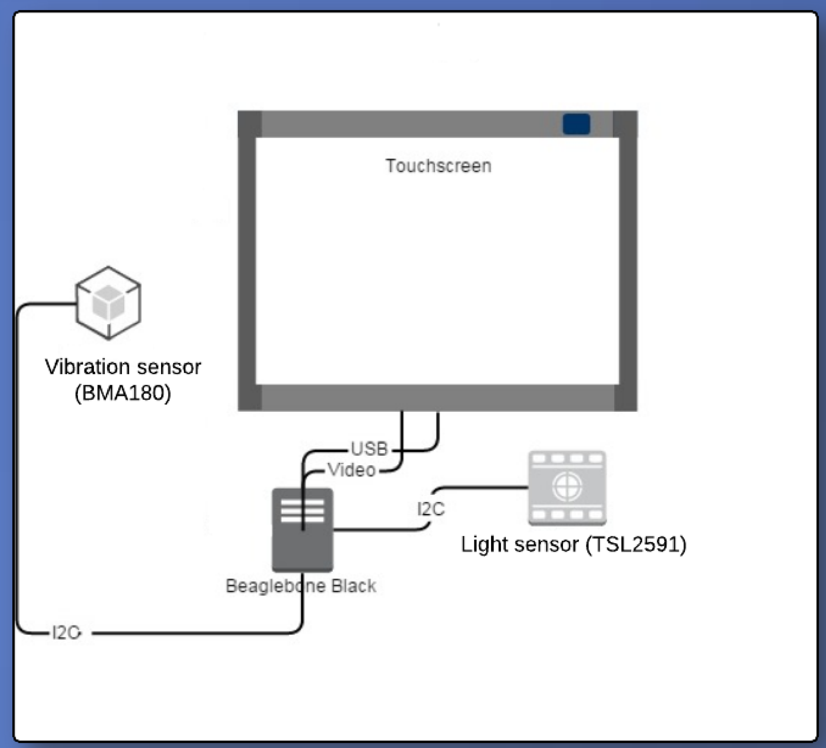
- To compensate for the presence of vibration
- To compensate for changes in light intensity
- To incorporate configurable compensation switch
- To design and conduct experiments to test system functionality



Beaglebone Black: controller

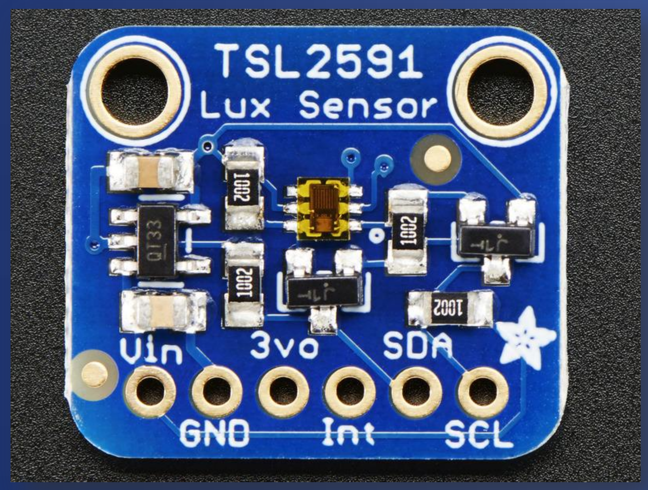
Design Solution

Both the light and vibration compensation algorithms have been implemented in C++ with a GUI (designed using QT). Light compensation is achieved by modifying GUI components contrast ratio based on input light intensity. Vibration compensation is attained by physically transforming the GUI based on the amount of vibration experienced.

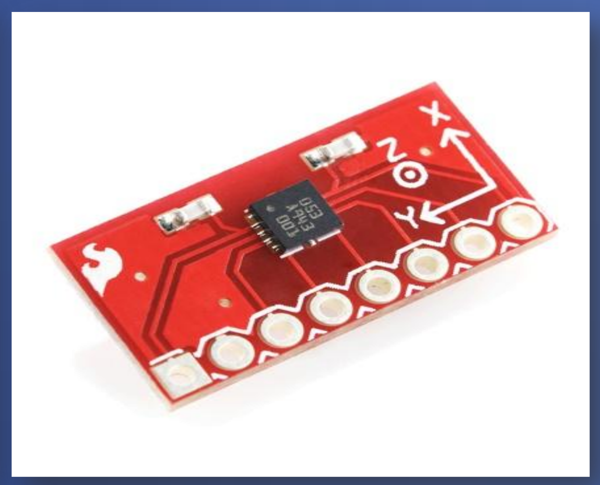


Physical Configuration

Physical diagram representing Physical components and connections in the system.

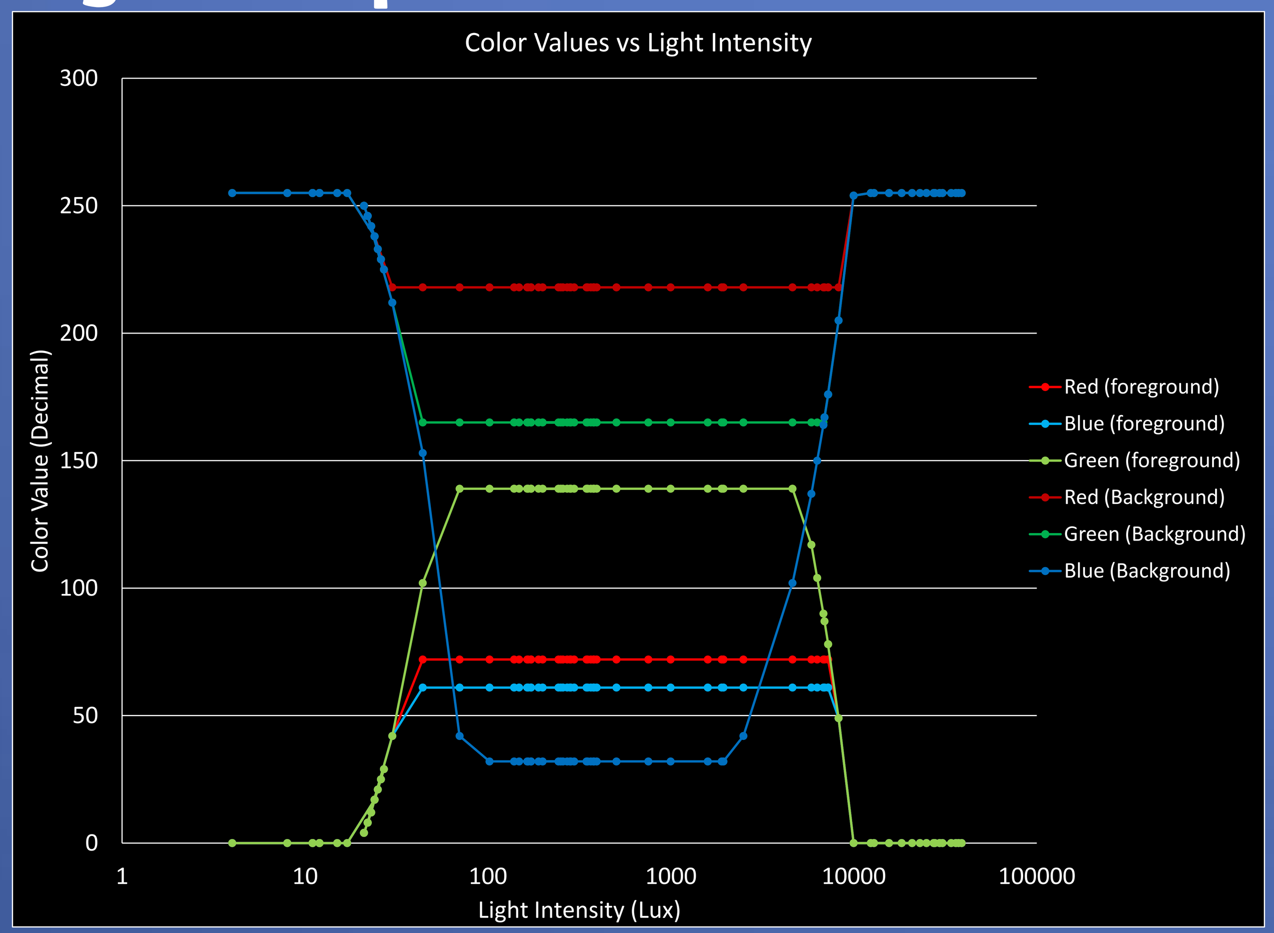


TSL2591 Light Sensor: for sensing light intensity at the surface of the touchscreen.

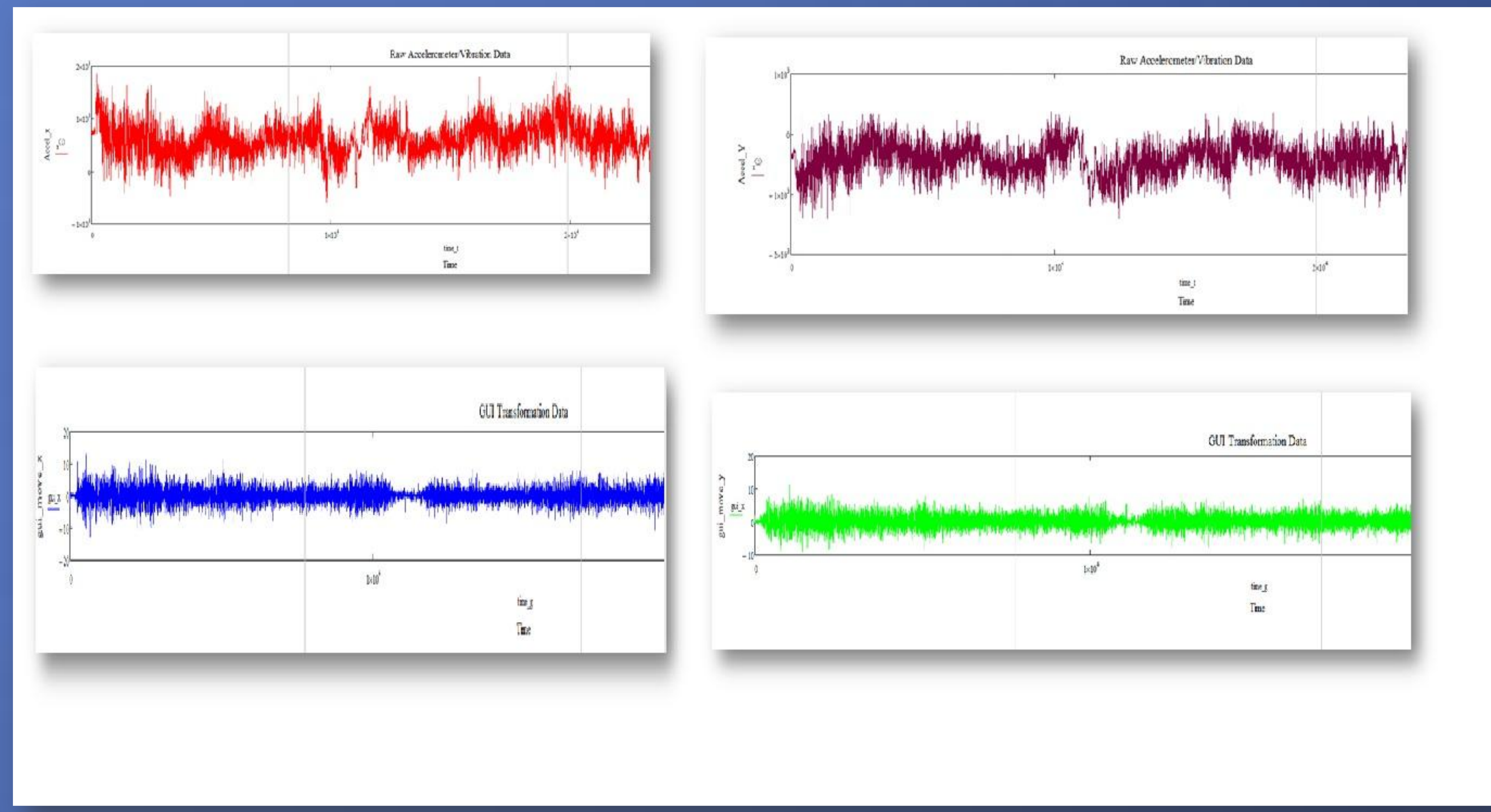


BMA180 Accelerometer: for sensing the vibration experienced by the touchscreen

Light Compensation Information



Vibration Compensation Information



The light info(left) recorded for varying source light intensities, shows the correlation between the light intensity of light hitting the surface of the screen and the RGB color values of the GUI components as they change. The vibration info(right) collected in a moving vehicle on a rough road(experiencing constant vibration), shows the raw sensor input data(x & y axis) and the corresponding output fed to the GUI for the GUI transformation.

Conclusion & Evolution

Our enhanced touchscreen product compensates for both the presence of vibration and changing source light intensities. Varying source light intensity is compensated for by varying the RGB color values of the GUI components to improve visibility. Vibration is compensated for by transforming the GUI to counteract the vibration experienced by the touchscreen system. With respect to light compensation, this product can be further enhanced in the future by incorporating functionality to compensate for shadows cast on the surface of the screen.

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