



# CALIFORNIA STATE SCIENCE FAIR

## 2015 PROJECT SUMMARY

<b>Name(s)</b> <b>Raghav Ganesh</b>	<b>Project Number</b> <b>J0912</b>
<b>Project Title</b> <b>A Wireless, Wearable, and Customizable Electronic Solution to Predict and Prevent Autistic Meltdowns</b>	
<div><b>Objectives/Goals</b><p>Autism spectrum disorder is a neurological and developmental disorder that affects 1 in 68 children and lasts a lifetime. Autistic people periodically experience intense, frustrating, and risky emotional outbursts known as autistic meltdowns. Autistic meltdowns are periods of emotional dysregulation that are triggered by high levels of cumulative stress, sensory overload, and the inability to communicate with caregivers. This project aims to develop an electronic solution to predict and prevent autistic meltdowns by detecting early signs of potential meltdowns, intervening through calming responses to the user, and alerting the caregiver.</p></div> <div><b>Abstract</b><p>My wearable device periodically monitors four environmental triggers and three physiological symptoms through environmental and physiological sensors. A microcontroller regulates the various functions of the device. A mobile application is paired with the device via Bluetooth. My device operates in three modes. In the Data Collection mode, the device periodically polls the sensors. The control software stores the calculated environmental and physiological parameters in a database. During the Data Analysis mode, the data from the database is transferred to a PC. The data is analyzed on the PC and user specific thresholds are generated for the environmental and physiological parameters. The caregiver can use the generated thresholds or override them if needed using a mobile application. In the Detection mode, the device continuously compares the monitored sensor data against the configured thresholds. When any threshold is exceeded, the caretaker is alerted about potential meltdown symptoms and a therapeutic response is initiated to calm the user. I tested my prototype revisions in simulated environments and with autistic users.</p></div> <div><b>Methods/Materials</b><p>My wearable device periodically monitors four environmental triggers and three physiological symptoms through environmental and physiological sensors. A microcontroller regulates the various functions of the device. A mobile application is paired with the device via Bluetooth. My device operates in three modes. In the Data Collection mode, the device periodically polls the sensors. The control software stores the calculated environmental and physiological parameters in a database. During the Data Analysis mode, the data from the database is transferred to a PC. The data is analyzed on the PC and user specific thresholds are generated for the environmental and physiological parameters. The caregiver can use the generated thresholds or override them if needed using a mobile application. In the Detection mode, the device continuously compares the monitored sensor data against the configured thresholds. When any threshold is exceeded, the caretaker is alerted about potential meltdown symptoms and a therapeutic response is initiated to calm the user. I tested my prototype revisions in simulated environments and with autistic users.</p></div> <div><b>Results</b><p>When tested with autistic users, this device successfully detected periods of high stress and meltdown antecedents. Caregivers and behavioral specialists found the mobile application and the wearable device to be user friendly and valuable.</p></div> <div><b>Conclusions/Discussion</b><p>My electronic solution met the design criteria, constraints, and the engineering goal. In the future, the components can be surface mounted to further reduce the cost and weight. Based on the evaluation of caregivers, test users, and behavioral specialists, my solution has the potential to improve the quality of life for autistic people and their caregivers.</p></div>	
<b>Summary Statement</b> <p>I successfully developed a wireless, wearable, and customizable electronic solution to predict and prevent autistic meltdowns.</p>	
<b>Help Received</b> <p>I am grateful to caregivers, users, and behavioral specialists for their input, feedback, and evaluation of my solution. I thank my parents for funding this project and online forums for technical support.</p>	