Test Scripts: VOC Monitor

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Table of Content

Introduction…………………………………………………………………………………………………………………………………………3

Arduino Test Scripts……………………………………………………………………………………………………………………………..3

Data Transmission Scripts……………………………………………………………………………………………………………………..4

Web Application Scripts………………………………………………………………………………………………………………………..5

Reference User Stories………………………………………………………………………………………………………………………….6

**Introduction**

This report will attempt to explain the User Interface of the VOC Monitor through the description of test scripts that are derived to support the VOC monitor user stories. To explain the system fully, test scripts have been categorized by logical components of the monitoring system in sequential order. The sections are as follows: Arduino Scripts, Data Transmission Scripts, and Web Application Scripts. While some sections do not concern User Interface they are included in this document for clarity.

**Arduino**

A sensor sends a ten-bit value through the Arduino where the value is then stored on an SD card. The following must be tested: sensor is correctly wired to board, the same value being calculated by the sensor is being stored on the SD shield, and the SD shield is also recording the correct date of retrieval. These test scripts were derived from the User stories: Curious George Learns to Troubleshoot and Curious George Tests Monitor

**Sensor Test Script**

To test if the sensor is wired correctly code the Arduino to output the values retrieved every second by the sensor onto the screen. Wait for the value to stabilize. Once the sensor values are constant, slowly blow on top of the sensor. If the values grow larger, the sensor is correctly embedded into the board. If the value remains the same, the sensor is not correctly embedded into the board.

**Data Retention Script**

To test if the values retrieved from the senor are the same as those being stored on the SD card, code the Arduino to output the next twenty values to the screen. Allow the code to also send data to the SD card. Record the twenty values that appear on the screen. Once the twenty values are retrieved, pull the SD card from the Arduino and insert it into the computer. If the twenty values that were recorded match what is present on the SD card, then the test has passed and the data hasn’t been corrupted. If the values do not match, the test script has failed and the data is being corrupted or incorrectly logged.

**Date Script**

To test if the correct date has been appended to the end of each VOC retrieval from sensor allow the Arduino to store one ten-bit value a day for five days onto the SD card. Once five days have passed pull the SD card from the Arduino and insert it into the computer. Check the values in the SD card. There should be five subsequent dates from the current day back. If that is the case, the test passed. If not, the test has failed and the date is not being calculated correctly.

**Data Transmission Scripts**

An XBEE is used to send packets containing Arduino sensor data to a nearby computer wirelessly. While there many test scripts for the XBEE data transmission, this section focuses on the User Interface for the user that directs data transmission from the XBEE to the computer. The user first gets within range of the XBEE to see a login window pop up onto the screen. Once successfully logged in the user is given the option to download old or new data. Upon making a choice VOC data is retrieved from the Arduino with ‘Downloading’ and ‘Download Complete’ messages. These test scripts were derived from the User stories: Curious George Retrieves VOC Data and Silly Sally Logins into a VOC Monitor.

**XBEE Range Script**

To test if the user will receive a login window upon being in range of the XBEE, set the Arduino next a computer with the thumb drive that links to the XBEE. Once running program, send a ‘Connection Request’ packet to the XBEE that will contain the computer’s address. The XBEE will then send a ‘Connection Reply’ packet if the packet contains the correct serialization number for that monitor. If not an ‘Error Packet’ will be sent containing a code that represents the source of the error.

**Login Script**

Once successfully connect to XBEE the program will ask the user for a login and username. The program will first check if the username exists within the login look-up table. If the login doesn’t exist, the error message ‘Login name does not exist’ will be displayed under the password box. Upon finding the user name, the password will be cross-referenced with the password in the look-up table. If the login exists but the password is incorrect, the error message ‘Incorrect Password will be displayed’. Once the login and password match, the login screen will disappear and a download window will appear.

**Download Script**

The download window offers two options: Download Current Data and Download New Data. To test downloading the system will retrieve the data packets from the XBEE. Once all packets are retrieved the number of ten-bit values will be calculated. One ten-bit value is retrieved every hour for each sensor embedded. If the number of ten-bit values is not double the difference in time between the first and last time stamp, a corruption flag will be set to 1. The flag has three possible options: 0(Download Successful), 1(Download Incomplete), 2(Download Failed). The Download Failed is set if less than five days’ worth of data is retrieved. A message will be printed to the screen indicating which flag was set. Upon an Incomplete or Failed download a technician will be sent to the monitor to check for issues.

**Web Application Scripts**

The web application allows end users to enter their e-mail address and choose different VOC monitors via zip codes to receive alerts from. The website also offers users the ability to download VOC data that hasn’t been put into graph form. There is a single graph (ppm vs. time) that depicts VOC levels for every given hour of the last week. A line displayed horizontally along the graph will mark the hazardous level of the selected VOC. These test scripts were derived from the User stories: Curious George Visits the Internet, Silly Sally Joins an Alert System, and Silly Sally Receives an Alert E-Mail.

**User Alert System Entry Script**

To test if a user has been inserted into the alert e-mailing list, an e-mail address along with a list of monitors the user wishes to receive notifications for will be submitted through the web application. The program will then attempt to add the e-mail and monitors to the database. If the e-mail address does not fit the ‘example@here.something’ format, an error message will be displayed asking the user to submit a valid e-mail address following a given example. If a zip code that a monitor serial number has been entered that does not exist in the database an error message will display telling the user which monitor serial number does not exist for that zip code. If an e-mail is submitted without errors, the test has passed. If errors continued to be displayed, the test has failed.

**E-Mail Alert Script**

To test if e-mails are being sent to users the system admin is to insert a faux VOC level that is above the danger zone recorded for that user. Upon entering the VOC level the system will iterate through the VOC levels checking that they are within a safe range. The faux VOC level will trigger another script that will iterate through users that are registered to the VOC monitor. This script will return a list of e-mails, the VOC that is above the safe range, symptom, and protection information for that VOC. Upon retrieving the list, users should receive a test alert system e-mail. If an e-mail was received, with the correct VOC with accurate information than the script has passed. If an e-mail was not received or received with incorrect information than the e-mail alert script failed.

**Graph Representation Script**

To test if the graph is displaying the correct VOC levels for the correct monitor, raw VOC data will be cross-examined. Each VOC level retrieved has the monitor’s serial number, the date, and time retrieved the level was retrieve. To check if the correct values are being displayed on the graph open the VOC raw data file for the corresponding VOC and monitor. If the level, date, and time that VOC levels were recorded match the graph, then the graph representation script has passed. If any VOC levels do not correspond with raw VOC data, then the script has failed.

**User Stories**

Follows are the user stories that were used to derive the above test scripts.

**Sir Curious George Sets up a VOC**

Sir Curious George the Second is quite bothered by the ruffians that set up a cleaning agent plant not six blocks from his very own abode. He has decided to take matters into his own hands, show those brutes what’s what, and install a Volatile Organic Compound (VOC) monitoring unit in his neighborhood. After a lengthy deliberation with the mayor, a dull fellow yet susceptible to bribery, Sir Curious George secures a permit to put up a VOC monitor. After contacting an electrician, the VOC is raised and secured roughly 20 ft. up a nearby power line pole. The VOC monitor is booted up and begins recording the data necessary to haul away the ruffians.

**Curious George Retrieves VOC Data**

Curious George is sitting in a car preparing to start his day. He realizes it has been a week since he last updated the VOC monitoring website. Knowing this he wonders how to get this weeks data. He knows he has to be close to the VOC monitor to retrieve the air quality data. He looks on the VOC monitoring website to get the location of the VOC and drives to the power line the VOC is attached to. Once safely parked he pulls out a thumb drive that is configured for the VOC monitor and plugs it into his laptop. Upon inserting the drive a window’s message pops up on the screen. The window asks for his login information. After logging in, the window continues to another. This message has two options: ‘Download New Data? Download Previous Data? Last weeks data made it to the database so Curious George chooses to download the most recent data. The computer starts receiving data from the VOC monitor. After a little while another Windows message pops on the screen that reads ‘Download Complete’. With the job done, Curious George heads to the local bakery.

**Curious George Visits the Internet**

George knew that his city had purchased VOC monitors and placed them around the town. One night George got curious about how his town was affected by the various nearby manufacturing plants and decided to look at the information himself. George contacted his city council to obtain the correct URL for the website that the VOC levels were displayed.

George visited the website and was floored by the beautiful, sleek design of the page. The front page had a picture of the VOC monitor and an explanation of how the system works. At the top of the page there were a few tabs that read ‘Graphs, Raw Data, and Nodes’. The ‘Graphs’ tab had a series of time-line graphs for each Volatile compound the monitors sense. The ‘Raw Data’ had downloadable documents containing unprocessed VOC levels retrieved directly from the monitors. The nodes had a map locating all the VOC’s around the town.

George was moved by the powerful mission statement that was displayed at the bottom of each page. George knew the website was updated every time VOC levels were retrieved from the monitors. George was sure he would visit the site again soon.

**Curious George Learns to troubleshoot!**

George was in the process of collecting files from the VOC monitors. While en route, he found a system that was not able to connect to his computer. Concerned, he removed the system from its post, acquired a working VOC monitor, and began troubleshooting. He began by checking the power source; the LED was glowing, so that wasn’t the problem. He next checked the black and red power wires to ensure they were connected properly, which they were. Next, he checked the XBEE by attaching it to the working VOC. The wireless XBEE module was also in working order. Finally, he took the SD card from the VOC monitor and plugged it into his laptop, finding that all the files were overwritten with junk. He checked the manual and found the only way that could have happened was by the program being corrupted, so George plugged the VOC into his laptop, uploaded the program onto the system, and put it back together. At last, it was in working order again!

**Silly Sally Joins an Alert System**

Sally could not sleep one night, so she left the warmth of her iComfort memory foam mattress and Harry Potter comforter to watch the tele. A documentary was airing about the effects of oil refineries on nearby populous. Some of the effects were quite discomforting, especially because her grandkids had an oil refinery neighboring their home town. In doing some research about that specific refinery, Sally found a website that monitored and tracked the output of specific harmful chemicals known to be emitted by oil refineries. She also noticed that the tracking was real time and that she could sign up to be on an emailing list would notify her if a chemical rose above safe levels. Sally immediately tried to sign up for the entire list of monitors placed in zip codes near to her grandkids. She, however, received an error message about the e-mail she entered. She realized she forgot a dot before the end. Sally then got another error, the ‘97604’ zip code she entered wasn’t being monitored. She removed that zip code and was finally able to feel at ease knowing she has an eye on her children.

**Silly Sally Receives an Alert E-Mail**

One evening, while Sally was making some tea and biscuits she heard her phone vibrate. She had received an e-mail from the VOC Monitor Website she registered for months ago. The e-mail specified that the monitor in her grandson’s zip code had recorded that a specific chemical was at a concentration harmful for humans. She forwarded the e-mail that came with some protection and symptom information to her grandson and called him to let him know. Thankfully her grandson was unharmed and he went out and bought facemasks just like the e-mail suggested. Both slept easier that evening.

**Silly Sally Logs into a VOC Monitor**

Sally was so excited when someone mentioned the VOC Monitoring system she joined during a neighborhood watch meeting. She could hardly contain herself when the committee decided to buy the system for their neighborhood. To keep costs down each person would take turns retrieving the VOC levels from the monitors after formal training. Her week to retrieve the data finally came. When she pulled up to the monitor she deployed the VOC Monitoring Program on the neighborhood watch computer in her car. She knew that right then the program had sent a message to the Monitor and that she would get a message back. Just then a login screen appeared. She wished then that she had written down the login information. She remembered that it started with an S. She tried ‘Sient’ but received a message that that user name wasn’t registered. Sally remembered the user name: Sentient. Even though she got the username right, a message told her the password was wrong. Sally finally called a neighbor and laughed to find the password was ‘password’. Sally was finally logged in!