~~Enhanced Robot Vision~~

~~the robot to have ‘eyes’ that can recognize ‘debris’~~

~~what would be considered fragile or a living thing for the robot to not affect it~~

~~declared a ‘pet’ to be a ‘debris’ that is to be removed~~

~~Surveillance System~~

~~able to have remote control access to its ‘eyes’~~

~~install a camera onto the robot~~

~~Better Travelling System~~

~~able to climb up stairs or navigate through steep terrain~~

~~Other Quality of Life changes~~

~~A longer battery life with quick recharge~~

The new OS (Fig x) can provide the users a cleaner interface when interacting with the robot. It is a Unix based OS which adopted the Graphical User Interface (GUI) which is also used by many OS, such as Windows, MacOS, Android and IOS. Thus, users could be more convenient when using our OS as it can show the functions of the cleaning robots with icons, users could operate the robot in a familiar way. As it is a light-weight OS, so it does not require heavy hardware resources to operate and run programs.

There will be some pre-installed applications (Fig x) for example, Cleaning Master   
(C.M.) is an application which lets the users have full control over the floor cleaning robot. With the minimalistic interface design, the user can check the states of the robot such as the battery status, filter status, nozzle status and more. Users can also change the settings of the robots via this application such as redefine the cleaning path and cleaning priority of robot, rename the robots, connecting the robot to their home assistance. With the music player pre-installed, users can play music with this robot if they want. With the Camera Capture (CC) application pre-installed, users can have real-time control access to the robot's camera.

The wireless firmware application (Fig x), makes firmware update so much easier. Traditionally, when a robot needs to update its firmware, that will require the user to connect the robot to their computer via a physical wire which causes so many inconveniences. With this new feature, users can update firmware and all pre-installed applications with just one click when the robot is connected to the network via Wi-Fi and no cable is needed.

Users can set the cleaning time configuration and scheduling, the cleaning speed, the cleaning path, the cleaning priorities and other features all with their smartphone via our application for smartphones. Users can pause and unpause the robot or even set up a “Don’t Disturb Mode” and “Quiet Mode” by this method. As the demand of controlling smart devices via home assistance is increasing. We decided to add the ability of using home assistance to control the floor cleaning robot. So, users can control the robot by their voice, for example by using Google Assistant (Fig x), “Hey Google, clean the kitchen and bathroom but not the bedroom at 1 p.m.” The robot currently supports Google Assistant, Apple Siri and Amazon Alexa.

We decided to upgrade the motors to a High Torque High Speed motor (HTHS motor) for the wheels and a Pulse-Width Modulation motor (PWM motor) for the. With the HTHS motor, the robots are able to navigate through steep terrain while maintaining their speed, thus having a better travelling system. With the PWM motor the robots are toggle to vacuum motor speed. Thus, it can reduce the noise level, when users enable “Quiet mode”, and the robots will slow down its wheels speed and vacuum motor speed in order to produce less noise.

In order to overcome tough terrains like uneven floors, small stairs and ramps, or small obstacles like socks, wires and cables, the wheels are up-liftable. For example, when ramps are detected, the back wheels will be lifted up in order to navigate through the ramps. A 360-degree-movable wheels design is also introduced, the wheels can turn at any angle, thus the robot can have more precise turns to have a better travelling system.

As for detecting obstacles, Infrared sensor (Fig x), Ultrasound sensor (Fig x), camera and camera sensors (Fig x) are introduced. These sensors can help the robots to identify obstacles detected by its size, density, distance and temperature. The robots can also recognize fragile or living creatures from obstacles by using the sensor and calculating, to avoid hitting or hurting animals or pets.

With an additional chip for real-time path calculating (Fig x), the robot can calculate its cleaning path automatically. The robots will receive the data collected from the chips and sensor, then those data will be decomposed by the mapping chips and sent to our server to calculate the best fit path which fits the requirement of the user. After that, the robot will receive the package from our server and load the path into its mapping chips and the robot will follow the path calculated by our server. By this method, a high efficiency cleaning path is generated, with avoiding dangers such as falling edges and stairs, also particular spots like corners and edges of the walls will not be missed anymore, and most importantly, the robot can back to its charging position and charge automatically.

This new nozzle (Fig x) is installed on the rear of the robot, corners and edges can be cleaned more easily. As this design of nozzle is smaller in size compared to front and back nozzles, it is aimed to clean the edges and corners of the walls. Bacterial killing UV light is introduced, as this feature is so useful during the quarantine period. The UV light is pointed toward the floor in order to sterilize the floor.

Lithium-ion battery (Li-ion battery) (Fig x) as it is already the best batteries technology. We successfully increased the volume of the battery while maintaining the battery size. The battery life is extended, as the cycle and frequency of charging is now deceased. The battery can be used for at least 5 cycles of cleaning on average before it needs to recharge. We also introduced the Quick Charge (QC) technology to the robot, and it is now only requiring 30 minutes to charge from 10% to 80%. The user can use the product more frequently instead of waiting for the robot to charge up.