CENG 3410

Smart Hardware Design

Project Proposal

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Project overview

The goal of our project is to design and create a smart, low cost air purifier for the average household. A laser-based aerosol sensor is installed such that the surrounding air quality can be detected, our sensor is able to detect PM1.0, PM2.5 and PM10 particles which are the main causes of health hazards. Our air purifier can be used in manual or auto mode where the airflow is adjusted automatically based on detected aerosol levels. Our air purifier can also be controlled remotely using a mobile app via Bluetooth for household convenience. A special feature that distinguishes our product from others commercially available options is that users can be notified in case hazardous levels of air pollution is detected via push notifications on their smart phones so that they could evacuate the vicinity as necessary.

Background and Motivation

Air pollution is being serious nowadays [1]. There is a great concern among the public, since some of the illnesses are caused by the polluted air, such as the allergic rhinitis. The allergic rhinitis means that some of the substances will affect the eyes, nose, pharynx and larynx. [2] It will lead to inflammatory response. There are two factors to cause the illness, including seasonal and perennial.

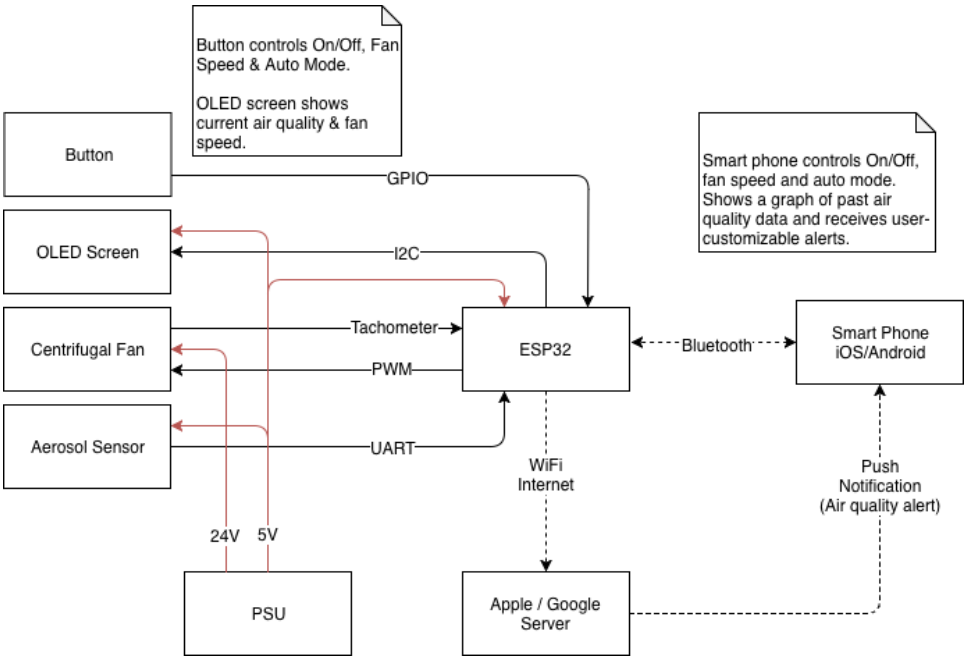
In the sector of perennial, dust is are included. The definition of air pollution is there are some harmful or excessive quantities of substances are introduced into air, such as gases, particles [3]. Dust is a kind of particles. Therefore, dust will negatively affect the patient.

Not only could the dust will affect the patient of allergic rhinitis, but also, dust mite is a major factor to lead to this disease. Dust mite is a very animal existing in the home environment, especially the bed and the sofa.

Although there are some drugs to alleviate the symptoms of allergic rhinitis, it is not a long-term solution. We strongly believe that we can develop a system to solve the problem at root, which is our motivation to start the project. Therefore, we would like to develop a smart air purifier.

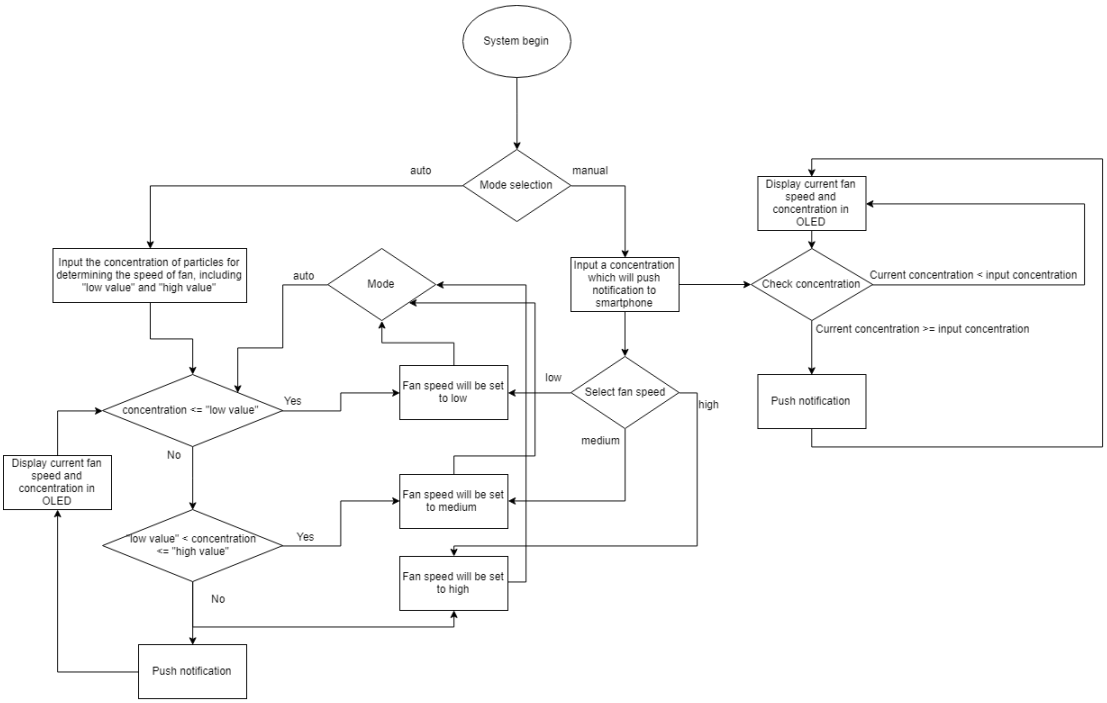
There are choices of air purifier on the market, such as Xiaomi - air purifier 2s and Dyson air purifiers. However, they contain some drawbacks, such as lack of functionality and the expensive cost. Therefore, we would like to find a balance between functionality and affordability. We believe that those will affect the market of our product. Therefore, we would like to design a smart air purifier with multiple functionality and competitive price.

Building blocks



The inputs of our system consist of data from the aerosol sensor, local user control (i.e. buttons) and remote controls (i.e. from smart phone). Outputs consists of the fan which pulls air through a smart phone app interface to view the status remotely. The logic is handled using a high performance SoC with Wi-Fi and Bluetooth support.

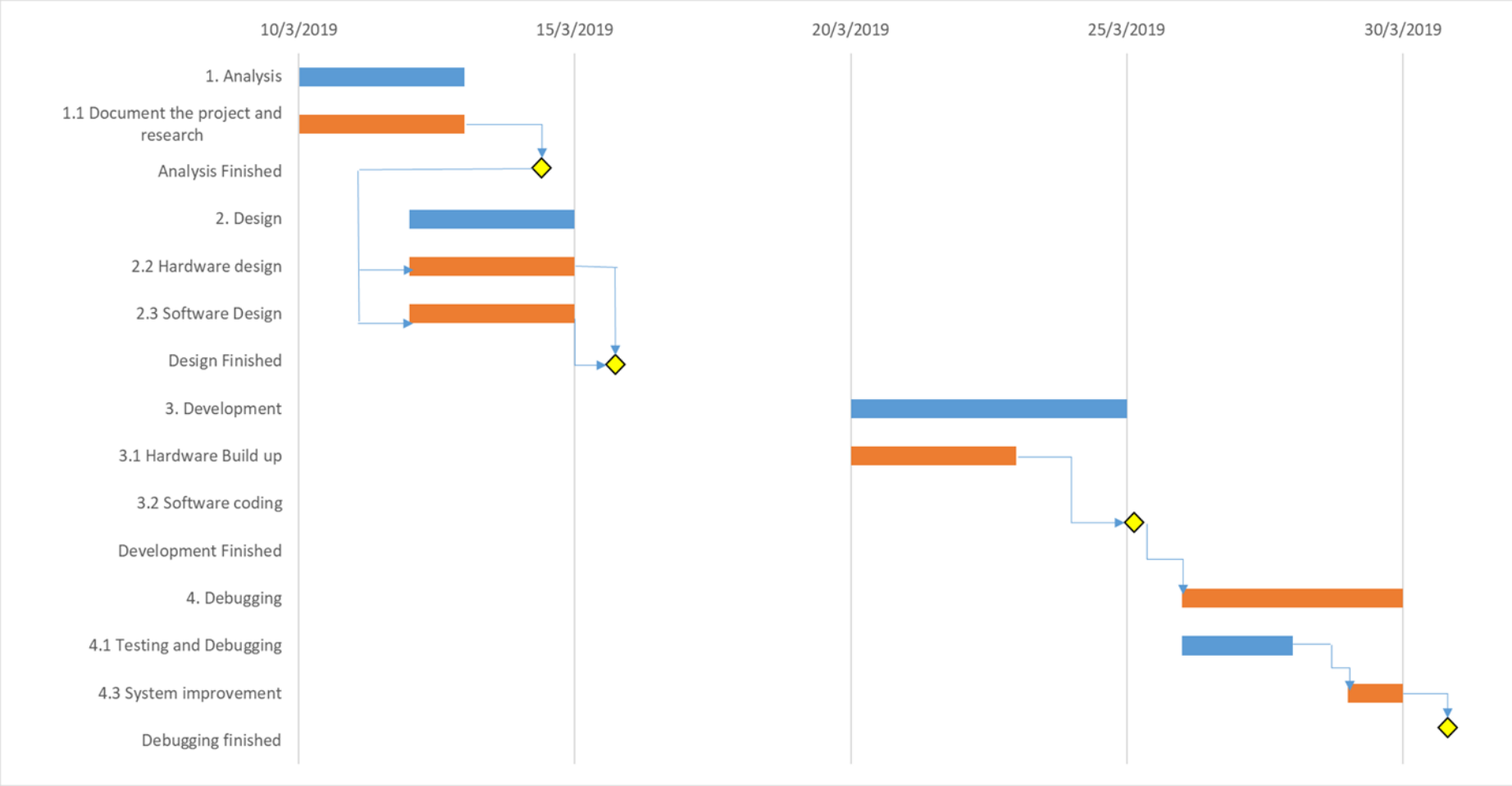
Working flow



The smart air purifier will design to two mode which are manual and automatic modes. For the manual mode. The aerosol sensor can detect the seriousness of air pollution. For the manual mode, the smart air purifier will be controlled by using smartphone's app. In the app, the concentration of dust and the current status of the smart air purifier will be shown. The device information will keep updated. It can help the user to control the speed of fans attributed to how many the dust is.

On the other hand, the user needs to enter the highest and lowest value of the dust concentration for the automatic mode. Then, the speed of fans will be modified automatically according to the air pollution value detected aerosol sensor. Also, the current status of the device will be displayed on OLED.

Gantt chart


10/3/2019
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1. Analysis
1.1 Document the project and research
Analysis Finished
2. Design
2.2 Hardware design
2.3 Software Design
Design Finished
3. Development
3.1 Hardware Build up
3.2 Software coding
Development Finished
4. Debugging
4.1 Testing and Debugging
4.3 System improvement
Debugging finished

References

[1] GovHK, "Air Quality in Hong Kong," 2 2019. [Online]. Available: https://www.gov.hk/en/residents/environment/air/airquality.htm. [Accessed 16 3 2019].

[2] S. H. Service, "Other Physical Health Problem," 15 12 2014. [Online]. Available: https://www.studenthealth.gov.hk/tc_chi/health/health_ophp/health_ophp_nos.html.

[3] "Air pollution," Wikipedia, 16 3 2019. [Online]. Available: https://en.wikipedia.org/wiki/Air_pollution. [Accessed 16 3 2019].

The division of labor

Hardware & Assembly:

Boris, Bosco

Embedded Firmware:

Alwin, Bosco

Mobile App:

Alwin, Boris