1. Remotely checking a house comprises of multiple tasks. Things that one would want to consider checking at all times in his/her house would include:

- Checking if the water is running
- Checking if the heat is on
- Checking for movement in front door
- Checking if kitchen stove is left on
- Camera Security system
- Data analysis for daily house temperature, and house light use.

This would require a combination of hardware that would each contribute in their respective purposes. To analyse the most efficient way to design a robot to remotely check the house I took each case separately and found the most efficient and cheap way to build the robot. Having reviewed most of the renowned processors in class, I would use the "Particle.io aka Internet Button", considering the house has Wi-Fi to ensure its proper functioning. It is relatively expensive at 49$ compared to other processors yet offers great advantages. Setting it up is very easy even for people who have no coding skills since it uses a build in app called IFTTT – If This Then That – which sends push notifications if certain conditions are met. To monitor the house I would use a total of 4 particles which will add up to a total of 196$ and including all the sensors the total price of the installation will add up to maximum 300$.

First of all to check if the water is running we would need to check two locations. The kitchen, and the bathroom. To check whether or not the bathroom sink or kitchen sink is

Figure 1

running, I would place a motion sensor on where the star is drawn in the picture and a the particle where the circle is shown. I would then add a heat sensor that would extend to the kitchen stove and take data regarding the activity of the kitchen stove, as shown in the Figure 2.

Figure 2

A light sensor would check if the lights were left on for a long time. We would check that by checking for abnormally high luminosity values over the night, which would indicate, some light source is powered in the house. The particle would then send a push notification to the owner to let them know and have it checked by someone.

I would also add another particle in on the corner of the main door and use its accelerometer to check whether the door has been used at all times which would once again send feedback to the owner of the house every time someone walks in or out of the house. I would also add a camera and place it as shown in the picture below which allow the owner of the house to watch exactly who is entering or leaving the house every time the accelerometer is moved. The heat sensor would surface data and trends regarding the temperature of the house at different time periods and the light sensor would once again generate data for further processing like checking if lights have been left on for a long time.

Figure 3

In order to check whether or not the heat is on we would place fourth particle on top of a radiator and add a heat sensor and program it to notify the owner every time the temperature of that heat sensor is much higher that the room temperature sensors in the entrance. The installation of the particle and heat sensor is depicted below.

Figure 4

Of course there are multiple assumptions we are making. First of all in order for the designed installation to work there would have to be year long Wi-Fi through which the particle could exchange information with the owner's phone. In addition the particles should be always plugged in a power outlet, so that they never run out of battery and consequently drop its Internet connection. In case connection is lost momentarily it is assumed that the particle will automatically connect back to the internet as soon as the internet connection is back. Finally, despite the built in IFTTT software, it would take some time to program all the conditions so that everything worked smoothly. Also, I would need to program the particle's room luminosity and temperature data to be graphed continuously so that any outliers were easily realized and the owner of the house is quickly notified. Other than that the particle offers an easy interface with which the owner of the house can expand its capabilities over time by adding more sensing features and allows the user to receive phone notifications instead of having to open a website or a computer program which could most of the time be neglected.