Project Proposal
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EE 41430

Senior Design Proposal
SmartLint ©

1 Introduction

The members of our group are William Bailey, Aaron Diaz, Ryan Frost, Rene Frank Gahitira, Salvador Llort, Grayson Zinn. The purpose of this project is to apply the engineering skills we have learned over the past 3.5 years and use them to solve a common problem with a new, innovative idea. Our project came from the Elevator Pitch Presentations and is named LintAlert. Our project would solve a real-world problem and would need different technologies and design ideas to solve it.

2 Problem Description

Every year, over 15,000 clothes dryer fires are reported each year — causing an estimated 5 deaths, 100 injuries, and $35 million in property loss. An estimated 34% of these can be attributed to excess lint build-up. Older dryers are still prevalent in many homes and apartment buildings and have no mechanism for detecting and/or communicating if and when the lint trap in a dryer is full. Cleaning the dryer lint trap regularly is necessary to decrease the risk of fires, but lint can also build up in the venting pipe and/or system. This problem is further complicated by households and multi-family living arrangements in which many different people use the dryer and may not know when or where to check for lint build-up.

3 Proposed Solution

To solve this problem, we first have to make our system measure the amount of lint and then communicate to the user if there is a critical amount of lint that needs to be removed. The communication can be with a LED, a noise, an email, or a notification to your phone. To measure the lint we have three possible options:

<u>Plan 1:</u>

Use a light and photoresistor to create a detector that will determine how thick the lint is and make a recommendation off that.

Materials needed:

- LEDs

- Photoresistor
- Power supply
- Circuit components (i.e., resistors, capacitors)
- Microcontroller
- Wifi

Plan 2:

Sense the temperature around the lint detector to test if it is heated up to a certain temperature.

Materials needed:

- Temperature sensor, likely a variable resistor
- Circuit components (i.e., resistors, capacitors)
- Microcontroller
- Wifi

Plan 3:

Detect the airflow in the lint trap to see if the air is still flowing in the trap.

Materials needed:

- Airflow sensor
- Circuit components (i.e., resistors, capacitors)
- Microcontroller
- Wifi

4 Demonstrated Features

We will demonstrate the ability of the sensor to detect reliably when the lint trap is full. To do this we can simply place an empty trap in and prove the alarm will not go off, then put in a full one and prove it will alert the user visibly (with an LED),audibly, and through a desired electronic notification.

5 Available Technologies

To create our project we will use the following technologies:

- Power supply (5V - 12V)
    - Possibly: power via micro-USB and voltage regulator
- Common circuit components (resistors and capacitors, negligible cost)
- Various sensors (photoresistors, temperature sensor, and air sensor)
    - Photoresistor (~$4): https://www.digikey.com/en/products/detail/seeed-technology-co.,-ltd/101020132/6558656?utm_adgroup=Evaluation%20Boards%20-%20Expansion%20Boards%2C%20Daughter%20Cards&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Product_Development%20Boards%2C%20Kits%2C%20Programmers_NEW&utm_term=&utm_content=Evaluation%20Boards%20-%20Expansion%20Boards%2C%20Daughter%20Cards&gclid=Cj0KCQiAhMOMBhDhARIsAPVml-H9s6pkvFjtbaUlCAoxqWdOOL2qxRPEiMptis0jd32Vt3bgTkT0CewaAl48EALw_wcB
    - Temperature sensor (~$6): https://www.digikey.com/en/products/detail/maxim-integrated/DS18B20%2BPAR/1197285?utm_adgroup=Sensors%2C%20Transducers&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Supplier_Maxim%20Integrated_0175_Co-op&utm_term=&utm_content=Sensors%2C%20Transducers&gclid=Cj0KCQiAhMOMBhDhARIsAPVml-Et7Du2NlMDQvOkKZWEciyEXLeDGLqPuamfOgwZ3yidxN4DfDJT9sgaAna5EALw_wcB
    - Airflow sensor ($170 - $280): https://www.degreec.com/products/embedded-airflow-sensors-switches/f-series-probe-air-velocity-and-temperature-sensor/
- WiFi-enabled circuit boards
    - Separate WiFi module (~$7): https://www.digikey.com/en/products/detail/adafruit-industries-llc/2491/5761206?utm_adgroup=RF%20Transceiver%20Modules&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Product_RF%2FIF%20and%20RFID_NEW&utm_term=&utm_content=RF%20Transceiver%20Modules&gclid=Cj0KCQiAhMOMBhDhARIsAPVml-F9Jjf-LIb5lDkQonmB3GAEtGPgY5wQhGgKhSJUHNuMxhrSsu_oNqYaAlt7EALw_wcB
- Alarm
    - Piezoelectric buzzer (~$1): https://www.digikey.com/en/products/detail/mallory-sonalert-products-inc./PT-2060WQ/1957868?utm_adgroup=Alarms%2C%20Buzzers%2C%20and%20Sirens&utm_source=google&utm_medium=cpc&utm_campaign=Shopping_Product_Audio%20Products_NEW&utm_term=&utm_content=Alarms%2C%20Buzzers%2C%20and%20Sirens&gclid=Cj0KCQiAhMOMBhDhARIsAPVml-Ebh2Yh8sYD9FMM7Aqi-KEDfyT0oCk7vv5vZmS66EL-RO2

nvXwdSE4aApztEALw_wcB

- 3D Printer ($0, already have access via Notre Dame)
- Dryer(s) to test/install device on ($0, already have access at home)

6 Engineering Content

Our team will first need to design a board in Eagle that contains a microprocessor, any circuitry needed for power, and the appropriate interfaces for communication. This can be broken out into several subsystems that can be engineered separately:

- Power supply
  - Any parts and circuit that is necessary to provide power to the microcontroller/WiFi chip and any sensors
  - May require a voltage regulator to create variable voltages to serve different components of the device.
- Sensors + necessary interfaces
  - Temperature sensor, 1-way communication w/ microcontroller
  - Light sensor (photoresistor), 1-way communication w/ microcontroller
  - Airflow sensor, 1-way communication w/ microcontroller
- WiFi module
  - Need WiFi module that is either off-chip (on board, but connected to a microcontroller such as a PIC32MX via an interface such as UART), or select a different microcontroller family/model that has WiFi built-in. This may also require
- Alarm
  - Add a programmable alarm to the board that can receive a signal from the microcontroller in order to trigger it depending on the sensor's readings. Will also require power routed to it from the power supply or the microcontroller.
- Casing to hold device
  - Will use CAD software to design and 3D-print a custom encasing to contain and protect the device and all associated circuitry. Must consider which sensors need access to which parts of the dryer (i.e., can't be contained) and design the product around this. We must also consider the potentially high temperatures in a dryer and ensure that the part will not melt or warp at these temperatures.

7 Conclusions

This project will require us to be innovative and think of new ways to solve this problem. We will likely encounter issues in making the device small enough to fit in a dryer, creating a device that can be installed on multiple models and types of dryers, and getting the device to reliably detect lint. This project will also require iteration as we think about the best way to layout our board, configure our sensors and assign

communication protocols, and design a user-friendly installation experience. However, through careful planning and iterative design, these problems can be overcome. If the project goes as planned, we could sell our product to appliance manufacturers like LG Electronics, Samsung, or Whirlpool for integration into their existing dryers. The device could also be desirable for individual homeowners or landlords who own older dryers and are interested in retrofitting these in order to prevent fires in their homes or properties.