Mission Folder: View Mission for 'Rocky Run'

State	Virginia
Grade	8th
Mission Challenge	Technology
Method	Scientific Inquiry using Scientific Practices
Students	renukamk mbulusu rmisra rblaze16

Team Collaboration

(1) Describe the plan your team used to complete your Mission Folder. Be sure to explain the role of each team member and how you shared and assigned responsibilities. Describe your team's process to ensure that assignments were completed on time and deadlines were met.

We met with a common passion in science in our classroom a few years ago. Recently, we decided to participate in this competition because of the tragedies that were happening in our neighborhoods. We decided to meet at each of our teammate's houses on a rotating schedule and every other Saturday. We partitioned the job between the four of us, such as programmer(who programmed the main components for our device), a researcher(who researched all of the information and statistics we needed), a builder (who implemented all of the ideas of the project creator) , and an project planner(who planned out the project such as what we were going to write, build and how we were going to accomplish it.). We answered one topic out of mission folder every week after we finished our app. Then we made sure that everyone was happy with the job they have accomplished for the week before we started and also that we have stayed on task. We assigned every team member homework to keep up to date and ensure we didn't fall behind.

Scientific Inquiry

Problem Statement

(1) What problem in your community did your team try to solve? Why is this problem important to your community?

Stove fires are the leading cause of house fires. Each year, around 3,400 people are killed in home fires, making it the third most common cause of accidental death at home. Most stove fires happen because home owners put something on the stove and forget about it. Our product hopes to address this negligence and eliminate deaths due to cooking fires. Recently in our community, there have been a couple of major house fires that have gravely impacted some of our close friends. When we were conversing with them later about what happened, they showed a few burns on their skin. We feel that it is our responsibility to protect ourselves and our neighbors so that our community will not be negatively affected by housefires again. Our solution uses the Raspberry Pi to alert individuals when they may have forgotten to turn off their stove. We accomplished this by attaching a temperature sensor to the Raspberry Pi GPIO ports and programming it to detect ambient temperature, and send an email to a certain phone to alert the homeowner to the impending danger.

(2) List at least 10 resources you used to complete your research (e.g., websites, professional journals, periodicals, subject matter experts).

1)"Home fires involving cooking equipment." (http://www.nfpa.org/research/reports-and-statistics/fire-causes/appliances-and-equipment/cooking-equipment)
2)"Learn Python the Hard Way." (http://learnpythonthehardway.org/book/index.html)
3)"Temperature Sensor Overview." (https://learn.adafruit.com/adafruits-raspberry-pi-lesson-11-ds18b20-temperature-sensing/overview)
4)"Send email from a Python script on the Raspberry Pi." (https://www.youtube.com/watch?v=0kpGcMjpDcw)
5)"Red Cross - Fire Prevention & Safety Tips." (http://www.redcross.org/get-help/prepare-for-emergencies/types-of-emergencies/fire#/About)
6)"Fairfax County - Fire and Rescue Home." (http://www.fairfaxcounty.gov/fr/)
7)"Popular Mechanics Magazine - 7 Steps to Better Fire Safety: Home Checklist." (http://www.popularmechanics.com/home/how-to/a2185/4226055/)
8)"Reader's digest Magazine - Fire Safety for Seniors." (http://www.readersdigest.ca/home-garden/cleaning/fire-safety-seniors/)
9)Expert: Fairfax County Fire Chief - Richard R Bowers Jr
10)"Fire Engineering - Structure fires: beware of the danger above your head." (http://www.fireengineering.com/articles/print/volume-168/issue-4/features/structure-fires-beware-of-the-danger-above-your-head.html)

(3) Describe what you learned in your research.

Initially, we were researching on other topics. Then, a tragedy occurred in our community . A cooking fire occurred in a house and one of the tenants could not make it out. We were heartbroken by this event and we resolved to stop a tragedy like this from happening again. We learned numerous informations that persuaded us to pursue our course of action. We first learned about the damages that fires can have and the extent of their damage. U.S. fire departments responded to an estimated average of 357,000 home structure fires per year during 2009-2013. These fires caused an annual average of 2,470 civilian fire deaths, 12,890 civilian fire injuries, and $6.9 billion in direct damage. We then learned about the sources of housefires. According to NFPA, nationally-recognized fire safety organization, cooking equipment is leading cause of house fires., at a enormous 45%! To complicate matters further, grease fires and dry kitchen fires are cooking fires that combust very quickly. These fires are extremely dangerous and can be very difficult to extinguish. Flames of these fires are generally very large and so the fire can jump from one area to another rapidly. Grease fires and dry kitchen fires are a threat to the entire home because they spread so quickly.

This research motivated us to create a device that can alert people to a cooking fire before it becomes uncontrollable. By using a Raspberry Pi computer near the stove, the chances of detecting the fire will increase and increase the chance of controlling the fire and, if the fire has already spread, then time for a safe egress. After the Raspberry Pi detects the fire, it will send an email. According to CTIA, a person responds to an email on their phone within 2 minutes. This is a quicker response time, faster than smoke alarms reaction and therefore potentially saving lives.

Hypothesis

(4) State your hypothesis. Describe how your hypothesis could help solve your problem.

Our hypothesis stated that creating a fire alarm with the added element of email notification would increase the chance of the fire being able to be put out and for the house to survive. Our hypothesis was very developed in the sense that it was reasoned on basis of previous information we had gathered. The reasoning that we put behind our hypothesis was that if a regular fire alarm had gone off, and the resident(s) were out of the house, then the house would surely burn down, unless the neighbors noticed. On the other hand, if the resident(s) received an email, they could call the fire department or anyone close to their house immediately to help put their fire out and to save the house.

(5) Identify the independent variables and the dependent variables in your hypothesis.

The independent variable, obviously, was what we changed throughout the experiment, which was the type of fire alarm. On one of our repeated trials, we sent a representative from our team out of the house, and blew a flame on a normal fire alarm, and in the other one, we used our temperature sensor that sent email notifications. Our dependent variable was the time at which the house was “rescued”. We timed how long it took for the “rescue” to happen for each scenario including calling for “help”, among others. We ended up proving our hypothesis correct through this elongated process, though it was worth it at the end!

(6) How did you measure the validity of your hypothesis? (In other words, how did you determine that your hypothesis measures what it is SUPPOSED to measure?)

The way that we showed this was definitely one of the easiest things we had done so far. As we drew the graph of the different repeated trials, we realized that we had stumbled across the possibility that our hypothesis was proven correct, through the correct way as well. Since we were testing efficiency, it was all dependent on the time it took, when trying to save one’s biggest life investment, the house. All the trials in which we had used the traditional alarm, the time was significantly higher by even hours, which would have possible allowed enough time for the whole house to burn down if it had been a real danger.

Experimental Design

(7) List the materials you used in your experiment. Include technologies you used (e.g., scientific equipment, internet resources, computer programs, multimedia, etc.).

We used a myriad of resources form the internet even though we were experienced, to check that we were on the right path, and so that we didn't make any mistakes significant enough to destroy our project. For instance we took examples of programs for fire alarms and temperature sensors from the internet and edited them to our liking for our specific project scenario. Another example would be we researched how to get the fire alarm to connect to an email notification by learning how to connect the Raspberry Pi to it The websites were such: “Learn Python the Hard Way.”, “Temperature Sensor Overview.”, and “Send email from a Python script on the Raspberry Pi.” We also happened to use the Raspberry Pi computer, the Linux programs that came with it, breadboards, and the temperature sensor itself.

(8) Identify the control group and the constants in your experiment.

Finding a control group for this experiment was especially difficult, because the “go-to” control group based on the default EDD template, would be to light something on fire with no fire alarm. Since we had to create one, we did it in the fashion in which the participant was actually in the house, with no fire alarm, to show that even a conventional fire alarm would be better than nothing or a fire alarm without batteries. We had to keep many things constant, on the other hand. For example, the house, so that the acoustics and temperature spread out evenly. Additionally, we had to keep the fire source the same so that the temperature and time the sensor went off were the same, and the device, so that everything would happen at the same time. We kept volunteer constant as well, so that the reflex times were similar. Finally, the distance the volunteer was away from the house was the identical every time as well.

(9) What was your experimental process? Include each of the steps in your experiment.

Our experimental process, though it might seem simple, was one of great intricacy. We started by picking a representative in our group, who was able to both hear pretty well, and able to feel phone vibrations in their pocket pretty well, too. Then we sent them to a local grocery store, and initiated the smoke detector. We then timed how long it took for them to come back, which was usually after the “shopping errand” had been performed, meaning that it took close to almost an hour every time, which would have caused serious damage if the fire was real. Then we tried sending them to the grocery store, but this time, instead of turning on the sound alarm, we turned on our device. They were able to either call their neighbors, or come back immediately, which reduced the potential damage time immensely, and agreed with our hypothesis. Though we did repeat each scenario multiple times, we also performed a control scenario. In this, we kept the person inside the house, and started a controlled fire that would not spread, but would still emit smoke, without either device. We had to wait until either they noticed something was wrong, came down to get a snack, or had go to the bathroom. This proved, as stated above, that even a conventional alarm was better than none.

Data Collection and Analysis

(10) Describe the data you collected and observed in your testing (use of data tables, charts, and/or graph is encouraged).

Along the way while we experimented with our Pi, we discovered many programs that would be instrumental to our device. As such, we would individually test all of these programs. The first program we tested was the temperature sensor program. First, we attached the temperature sensor to the GPIO board. Then we made a program that would record the temperature in Celsius. We observed the recorded temperatures on the screen of our computer and noted these down as follows:
25.5
26
27
24
25
These were the average temperatures we saw the most.

We then experimented with a program that allowed us to send an email via the Raspberry Pi. We created an email to test this out. We then sent trial emails to one of our teammates’ email address. We then figured out how to combine the two emails so that if the temperature exceed 32 degrees Celsius, it would send an email to the address. We observed that the email would send a minute later, and fixed the program so instant messaging was possible.

For our surveys, we handed them out in the public library to around 20 people, as well as handed them out to a few people in our local neighborhoods. We wanted to have all people taking the survey be adults, because they would be best suited to answer our questions. Also, we tried to keep an equal balance in age differences, between younger adults, middle-aged adults, and elderly adults, so we could get a broad perspective view on our topic. The exact results of our survey are displayed in our graphs below, but in broad terms, we were surprised by how many people have experienced a house fire in some way, and were happy that majority of people thought that a

product like ours would be beneficial to them.

(11) Analyze the data you collected and observed in your testing. Does your data support or refute your hypothesis? Do not answer with a yes or no. Explain your answer using one of the following prompts: 'Our data supports/refutes the hypothesis because...'

Our design statement is as follows:

Due to many recent instances of neighborhood stove fires, caused by the unwilling neglect of such kitchen appliances, we have decided to create a device that, unlike a standard fire alarm, would send a notification to the user requesting them to turn off their stove before its temperature reaches dangerous levels. This device will be able to detect the temperature of its environment and send a text message or email to the user once the temperature reaches a certain level, namely the ~350 degrees of a fire in its beginning stages."

Taking this into account, our data does support our design statement, as we were able to successfully program the device to send an email to an address through the Simple Mail Transfer Protocol once the temperature reading on our GPIO sensor reached 30 degrees. After we got it to work, we set the temperature sensor to more realistic levels of heat.

(12) Explain any sources of error and how these could have affected your results.

Errors may have been caused by faulty wiring on the GPIO breadboard. We carefully installed the temperature sensor and resistor in very specific places. If they fell out, someone could accidentally put it in the wrong place. This would tamper with the results, as the data would go through the wrong ports. Because of this, we took great care in inserting the device into the GPIO board. Any botches in the programs would also be sources of error. Because of this, we took time to test and perfect our programs. We would test the programs after every new function we added, and this allowed us to properly create the program.

Drawing Conclusions

(13) Interpret and evaluate your results and write a conclusion statement that includes the following: Describe what you would do if you wanted to retest or further test your hypothesis. Evaluate the usefulness of the data your team collected. What changes would you make to your hypothesis and/or experimental design in the future, if any?

House Fires are a major problem in the U.S that afflict thousands of people every day. We believe that our experiments can solve this problem because they reveal an inexpensive, effective, and efficient method for preventing cooking fires from happening again . Our tests have proven that our Raspberry Pi can reduce fires by about 38.2% and make the community a safer place.

From conducting our experiment, it became extremely clear to us that our device was very effective at preventing house fires, in a small and inexpensive package. Also, from holding our survey, we learned that many people would find our device useful in their daily lives. To further test our hypothesis, we would place volunteers in more diverse everyday scenarios, such as at a school, rather than just at the grocery store. In addition, after changing our device a little bit, and possibly creating our own application, we would tweak our hypothesis and experimental design to test the different types of device models, in order to see which one was most portable and user friendly, as well as test which form of notification (email, text, or application) was most effective at preventing a fire.

Uploaded Files:

- [View] **Email Message** (By: Advisor, 02/29/2016, .docx)
  Enclosing a screenshot of the email received on the phone alerting us
- [View] **Performing the experiment** (By: Advisor, 02/29/2016, .docx)
  Conducting the experiment and generating the email message
- [View] **Survey Results** (By: Advisor, 02/29/2016, .docx)
  We conducted survey in the community and in the library, gathered results and did graphs for our testing for analysis
- [View] **Temperature sensor** (By: Advisor, 02/29/2016, .docx)
  Python Code that enables Raspberry Pi to send email to the home owner to allow the homeowner to come back and stop the fire from spreading

Community Benefit

(1) How could your experiments and data help solve your problem and benefit your community? Describe next steps for further research/experimentation and how you have or how you could implement your solution in the future.

Many Public Service Announcements have been made to address house fires, but to no avail, as it would be impossible to teach everyone the proper kitchen safety rules. In the midst of all of this, we have proposed a solution to combat the issue. Using the Raspberry Pi, a small portable computer with extensive programming capability, we have created a device that will monitor the stove and temperature of it, and will alert the user with an email if the temperature levels get dangerously high. With this, the user will be encouraged to turn the stove down or go monitor it if they have not been previously doing so. This would keep people more alert so that stove fires wouldn't arise. In addition, our experiments have proven that our device is in fact more effective than a customary smoke detector at preventing fires, and if a stove fire were to form, our device would be the best at stopping them and saving lives.

To further our research, we would first and foremost experiment with our device in more scenarios, such as on grills, or with more people. This would give us a better understanding of how well our device works in all possible outcomes, and help us tweak our device to meet the needs of others. Some of our primary changes would likely be to have our device send text messages instead of emails, because text messages are more common in today's smartphones, and making the device more portable, so owners can easily move around with it.

Next, we would research how to program an application. An application of our own would help us in many ways, as we would be easily able to send notifications, rather than bothering to pay for text message service, or interacting with the Simple Mail Transfer Protocol (SMTP) Server. We would also be able to do more than just send notifications with an application. For example, we could use cameras to send a live feed to a user's smartphone. Or, we could send a statistics feed to a user's phone, that tells a user stove temperature and stove usage times for the past week, month, etc. So, an app would definitely be our next course of action.

Mission Verification

(1) Does your Mission Folder project involve vertebrate testing, defined as animals with backbones and spinal columns (which include humans)? If yes, team must

complete and attach an IRB approval form.

No

(2) Did your team use a survey for any part of your project? If yes, team must complete and attach a survey approval form.

Yes

(3) You will need to include an abstract of 250 words or less. As part of the abstract you will need to describe your project and explain how you used STEM (Science, Technology, Engineering and Mathematics) to improve your community

Thousands of people die and are injured because of kitchen fires every year. Approximately 589 million dollars are caused by cooking fires every year. A lack of early detection makes preventing these fast-spreading cooking fires from happening.

A device that contacts a person during the fire's infant stages allows people to realize that a fire is starting and they can put it out before the fire becomes uncontrollable. It is because of this reason that we have decided to create a device that can send an email to people when the temperature of the stove is at a level where it can potentially become a fire and starts to cause havoc.

After researching the topic, consulting fire safety experts and conducting many experiments, we designed the final device. The Raspberry-Pi is inexpensive and safe. We used Python programming language to program the device to recognize when there is a spike in the temperature of the stove and the temperature probe is activated. We also studied various engineering principles in order to understand where it is the optimal position to put the Raspberry Pi computer to detect the temperature spike. Another way that we incorporated STEM into the project is by studying Math to understand when the fire will become uncontrollable and how quickly does the average cooking fire combusts in. This device is a highly effective, easily implementable and foolproof device to solve the destructive problem of cooking fires in the future.

Uploaded Files:

- [**View**] **Photos of survey** (By: Advisor, 02/29/2016, .docx)
  We did a survey going door to door and at the library.
- [**View**] **Our Survey Questionnaire** (By: Advisor, 02/29/2016, .docx)
  We conducted a survey. Attaching the document that has survey questions
- [**View**] **Survey Approval Form** (By: Advisor, 02/29/2016, .pdf)
  Enclosing the survey approval form
- [**View**] **Letter** (By: Advisor, 02/29/2016, .docx)
  Letter to the fire chief explaining our project and permission to show him our device

(no subject) Inbox

R

raspberrypimrrr2016mlg@gmail.c...

to

Hide details

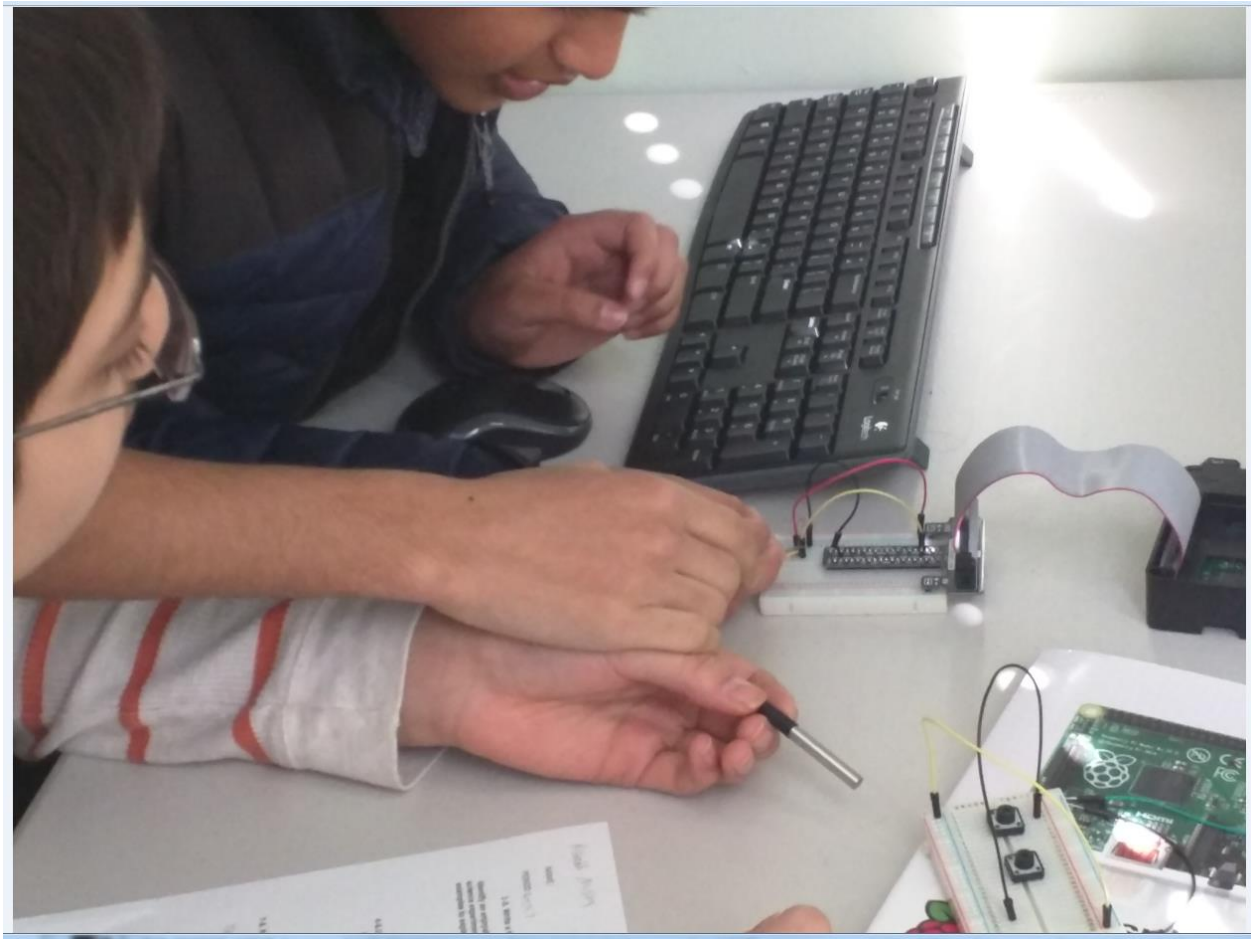
From: raspberrypimrrr2016mlg@gmail.com

Date: Feb 28, 2016, 11:22 AM

Temperature is high - TURN OFF YOUR STOVE! Call for help if needed!

Reply Reply all Forward


Raspberry Pi
User Guide
WILEY




Eben Upton
Gareth Halfacree
WILEY


WILEY

(no subject) Inbox

R

raspberrypimrrr2016mlg@gmail.c...

to

Hide details

From: raspberrypimrrr2016mlg@gmail.com

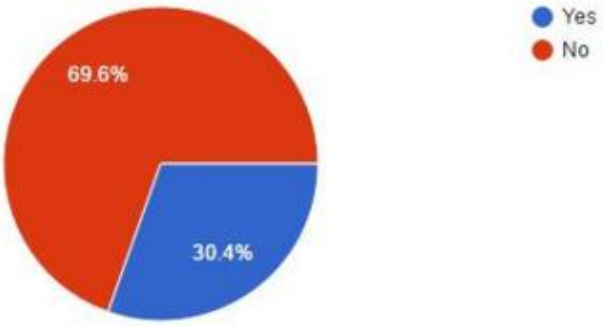
Date: Feb 28, 2016, 11:22 AM

Temperature is high - TURN OFF YOUR STOVE! Call for help if needed!

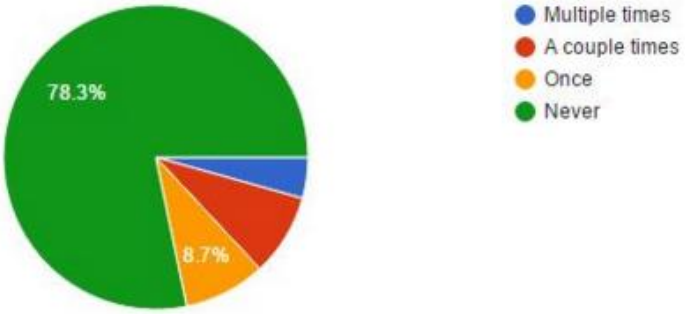
Reply Reply all Forward

Graphs based on survey responses:

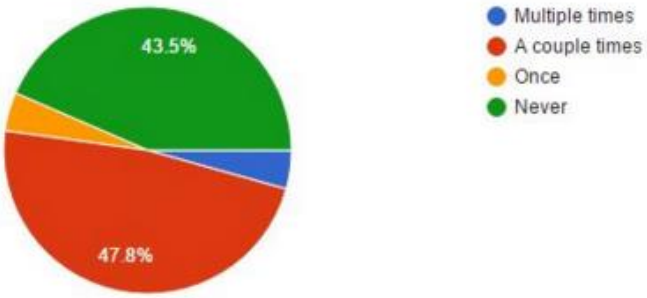
Do you use remote monitoring systems to oversee your house? (23 responses)



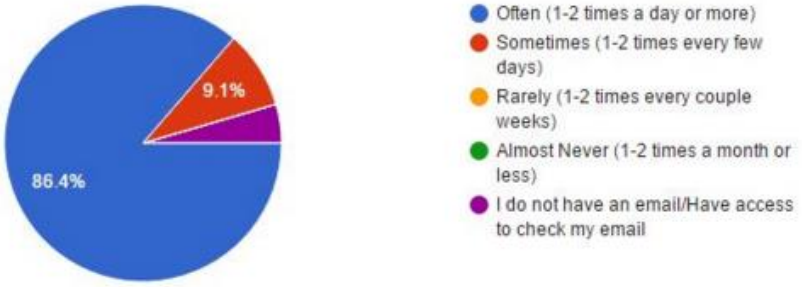
Has your fire detector ever not worked? (23 responses)



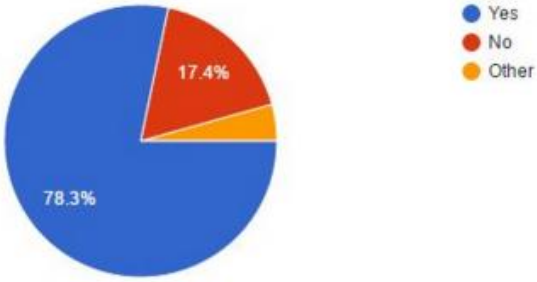
Have you ever forgot to turn off your stove? (23 responses)



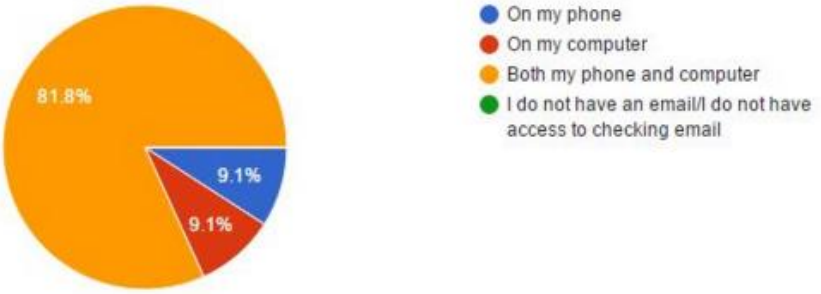
How often do you check your email? (23 responses)



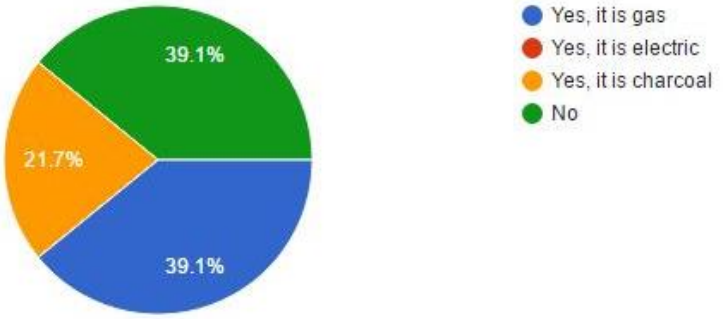
Would a fire alarm that sends a email to you if you leave your stove on for too long be benefical to you or someone you know?
(23 responses)



How do you check your email? (23 responses)

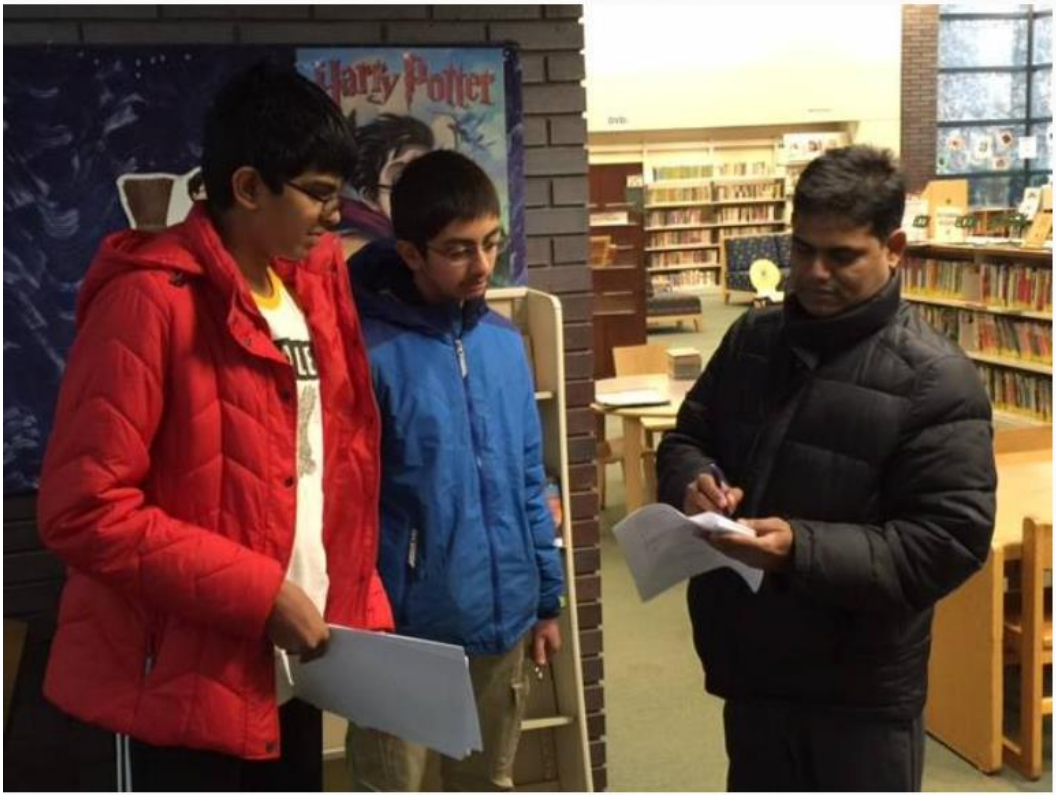


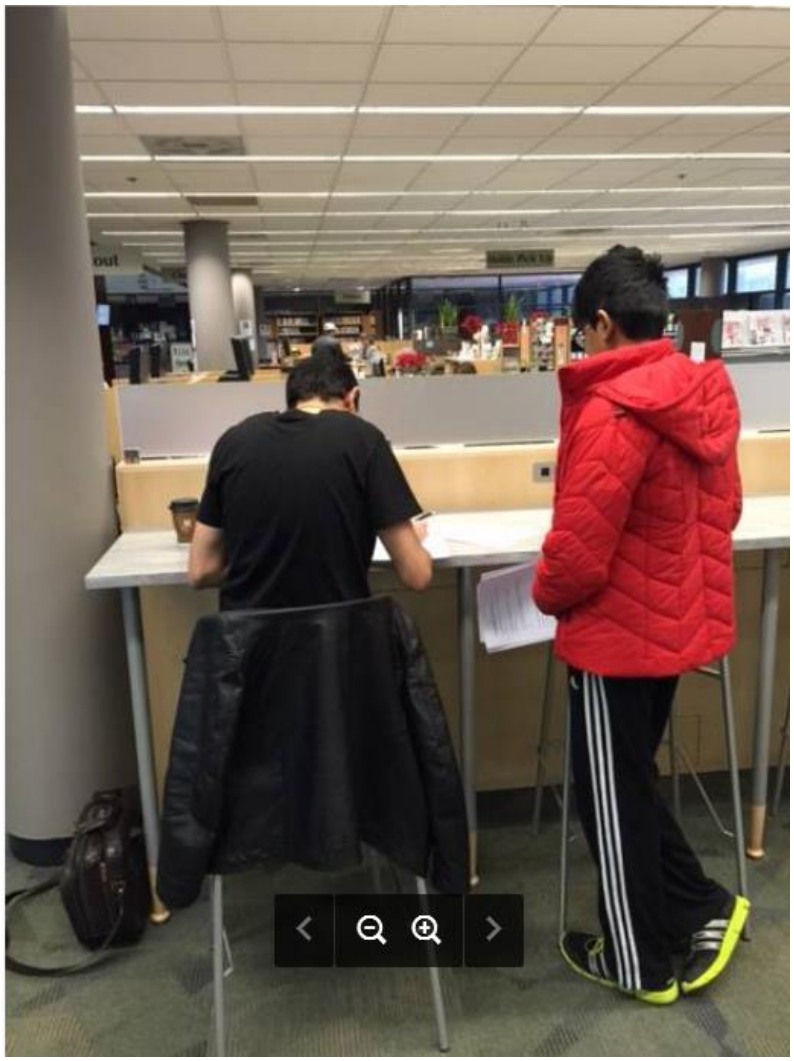
Do you own a grill? (23 responses)

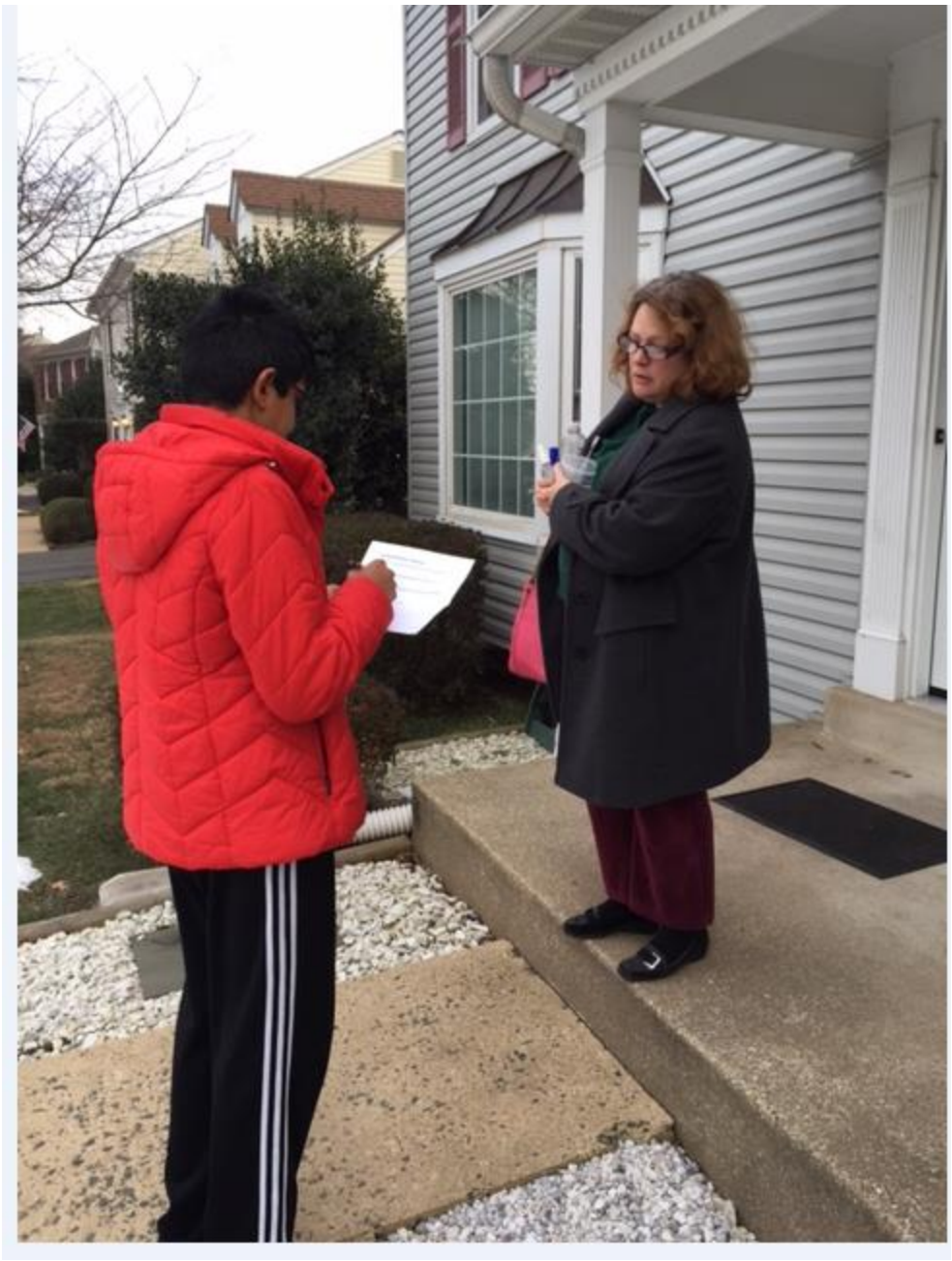


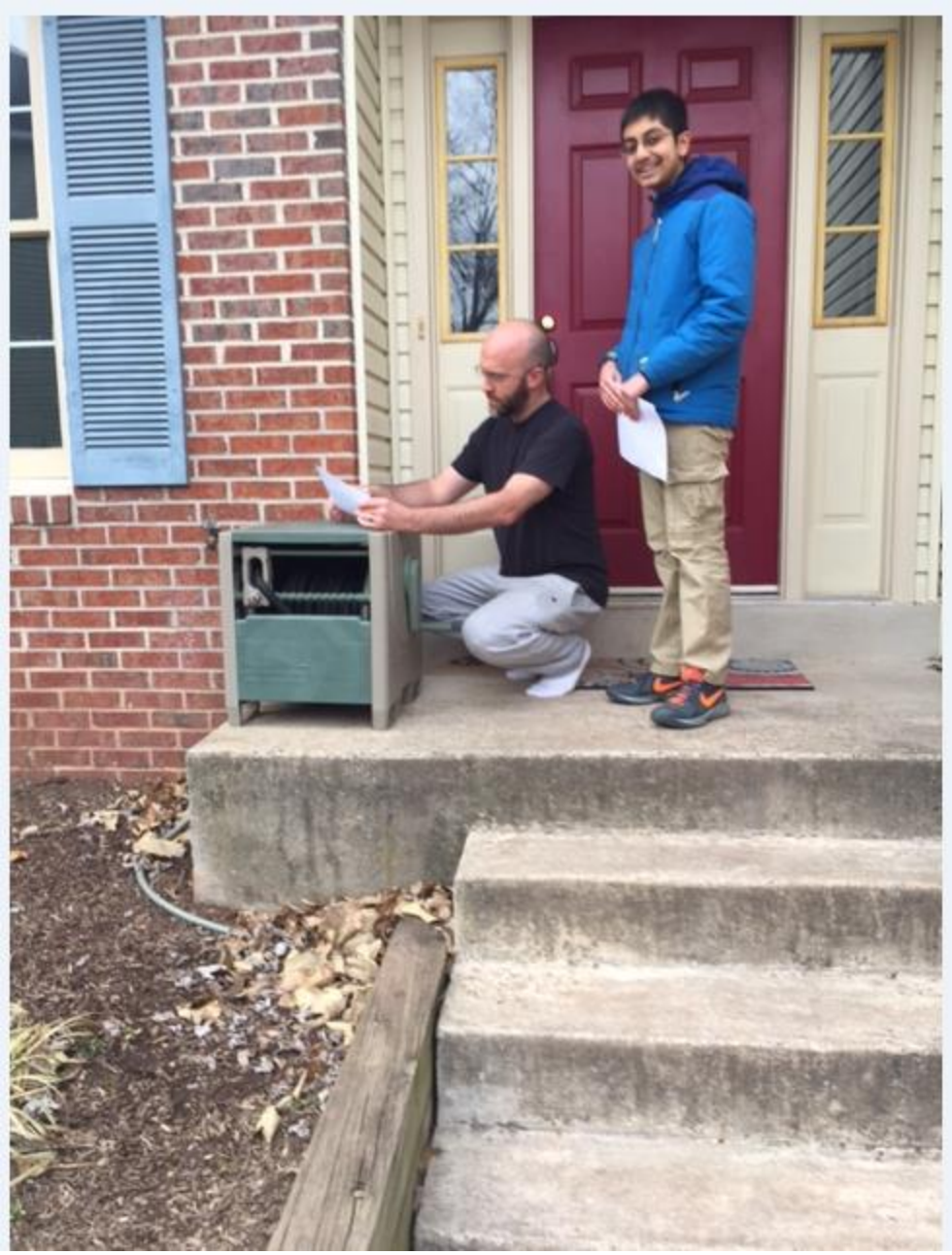
```
import os
import glob
import time
import smtplib

os.system('modprobe w1-gpio')
os.system('modprobe w1-therm')

base_dir = '/sys/bus/w1/devices/'
device_folder = glob.glob(base_dir + '28*')[0]
device_file = device_folder + '/w1_slave'

def read_temp_raw():
    f = open(device_file, 'r')
    lines = f.readlines()
    f.close()
    return lines

def read_temp():
    lines = read_temp_raw()
    while lines[0].strip()[-3:] != 'YES':
        time.sleep(0.2)
        lines = read_temp_raw()
    equals_pos = lines[1].find('t=')
    if equals_pos != -1:
        temp_string = lines[1][equals_pos+2:]
        temp_c = float(temp_string) / 1000.0
        temp_f = temp_c * 9.0 / 5.0 + 32.0
        return temp_c

while True:
    print(read_temp())
    time.sleep(1)
    if read_temp() > 32:
            content = 'Temperature is high - TURN OFF YOUR STOVE! Call for help if needed!'
            mail = smtplib.SMTP('smtp.gmail.com',587)
            mail.ehlo()
            mail.starttls()
            mail.login('raspberrypimrrr2016mlg@gmail.com', 'mlghjkasdf')
            mail.sendmail('raspberrypimrrr2016mlg@gmail.com', 'manubulusu@gmail.com',content)
            print ('Sent Email')
            mail.close()
            break
```


EAGLE
CYCLE
HERE


Harry Potter







eCyberMission Survey

* Required

Do you cook with an open stove? *

- ○ Often
- ○ Sometimes
- ○ Rarely
- ○ Never

Do you use remote monitoring systems to oversee your house? *

- ○ Yes
- ○ No

Have you ever forgot to turn off your stove? *

- ○ Multiple times
- ○ A couple times
- ○ Once
- ○ Never

Has your fire detector ever not worked? *

- ○ Multiple times
- ○ A couple times
- ○ Once
- ○ Never

Do you own a grill? *

- ○ Yes, it is gas
- ○ Yes, it is electric
- ○ Yes, it is charcoal
- ○ No

Have you ever experienced a house fire in any way? *

Can you recieve texts?

- ○ Yes, but only SMS style
- ○ Yes, also with iMessage and other free messaging systems
- ○ No, I have a slightly older phone
- ○ No, I don't own a cell phone

Would a fire alarm that sends a text message to you if you leave your stove on be benefical to you?

- Yes, I am forgetful
- No

Submit

Never submit passwords through Google Forms.

6th = 137

eCYBERMISSION Survey Approval Form

eCYBERMISSION team name: Rocky Run

Team Advisor name: Renuka Miriyala

Team Advisor email: renukamk@yahoo.com

Team Advisor phone: 408-204-6708

Student usernames: Revanth Vejju, Rishabh Misra, Manu Bulusu, Raghav Kannan

School name: Rocky Run

School address:

Describe the survey your team will conduct:

Creating a device to prevent house fires

Describe the participants you plan to distribute your survey to:

Library, House visits, Fire Squad

Project approved by school administration?

☑ Yes ☐ No

Approved by: Anthony S. Terrell

Title: Principal

Date approved: 25 FEB 16

Signature, School Administrator:

*Please save form and upload to your team's Mission Folder.

Rocky Run Middle School
4400 Stringfellow Rd
Chantilly, Va 20151

Dear Mr. Richard R Bowers Jr,

We are four 8th graders who live in Fairfax County. First and foremost, we would like to thank you for your service. Every day, we can be assured that we are safe from fires thanks to your hard work. We are sending a letter to you to tell you about a product we have been developing for the past few months to help prevent fires. We hope you enjoy it.

Our product idea originated when there were a couple of house fires in our community which resulted in injuries to people who were very close to us. We felt it a duty for us to prevent any more of these fires from happening, so others we know would not be negatively affected. So, we enrolled in the eCyberMission challenge, which is a challenge that prompts young students to create an effective and creative solution to a problem in their community. From there on out, we met once every week to work on our product and develop it into something that could be extremely beneficial. The exact process for how we built our product is below, but our product is essentially a small device that will alert you if you leave a stove of other cooking appliance on too long by measuring if the temperature of it is too hot.

Building our model prototype was a fun and interesting process. To start, we bought a Raspberry Pi computer and learned to program in Python. We did this by reading books about Python and watching tutorial videos on Youtube, as well as getting occasional guidance from our parents if we were struggling on a certain topic. Then, we bought a Raspberry Pi temperature sensor and learned how to program and use it effectively by visiting the Adafruit website, so that way we can use it as our ‘heat notification’ mechanism. After that, we figured out how to have the Raspberry Pi send emails via the Google Mail server, and using our previous knowledge of Python with our newfound knowledge, we joined both of them together. Now, our Raspberry Pi will send an email to a stove or grill owner if they leave their appliance on for too long and it becomes heated to the point of danger. In the future, we would like to implement text capabilities as well as carbon monoxide recognition.

We hope you liked our product idea, and find that it can be extremely useful. We would also like to meet with you to discuss our product in person, and receive any feedback. Thank you once again for your service, and we hope to hear back from you soon.

Sincerely,
Rocky Run Middle School eCyberMission Team