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Criterion A: Investigation

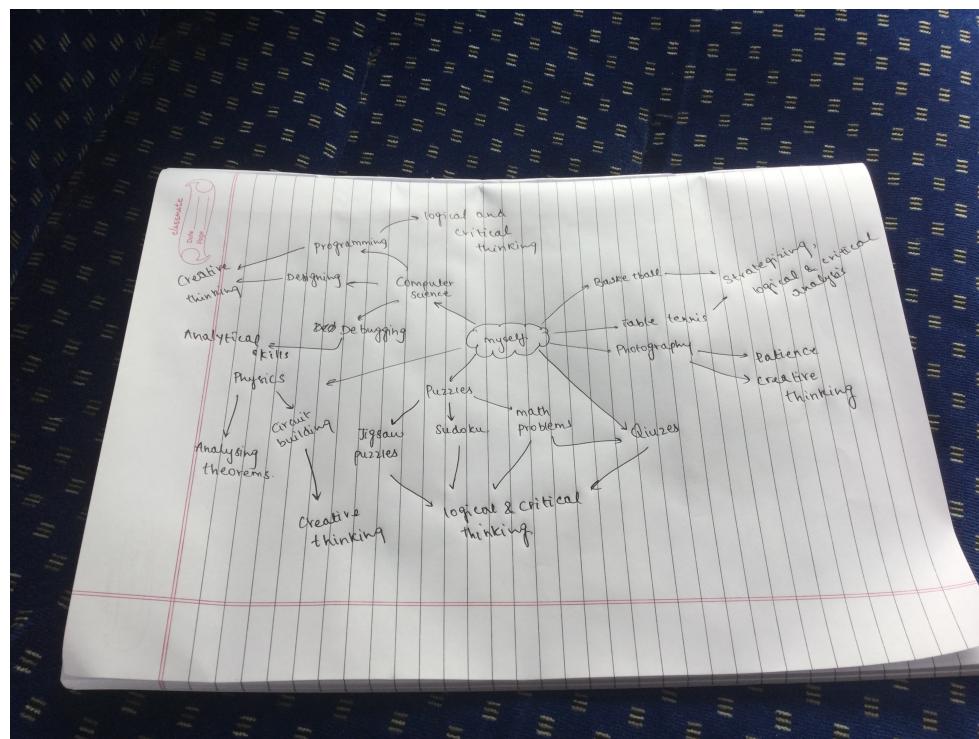
I. Defining a clear goal and global context for this project, based on personal interests

I was briefed about the personal project on the 1st of May: about the requirements, the components and post its completion. The one thing that caught my attention was “the project is to be made with respect to your passion and interests.”

Immediately, I took out a book and started drawing a mind-map in order to understand myself, it was me put down on a paper. Through the mind map, I was able to understand my:-

1. Strengths
2. Weaknesses
3. Hobbies
4. Favourite subjects
5. Fears
6. Constraints

And others.



From my mind map, I understood my strengths are logic building, critical analysis, creative and critical thinking. With these in mind, I started structuring ideas which could play to my strengths. I realised that the skills required in order to execute any of the planned ideas are pertaining to the subject of computer science, or in other words, digital design; hence I started thinking on those lines. I recalled everything from talking to my dad to watching a sci-fi movie, and make up with a set of possible solutions - which might be impractical given my limited knowledge and skill set but was very much possible.

The IB global contexts are guide lines which help guide a student's thinking in the right path by providing criteria and questions. This global context must be in accordance with the personal project chosen. In my case, I decided that the most suitable global context was "scientific and technological innovations. "Why you may ask? Well, the global context revolves around how one uses his or her knowledge and skills to bring about innovations, discoveries and advancements to technology and science which could not only benefit themselves, but would serve the cause of benefitting many others. I've always been an active participant of community service and have always had the drive to help others around me. This attitude of mine helped me consolidate my ideas and structure my device. In addition to that, the global context helped me focus and primarily think on those lines allowing me to come up with the idea of saving lives at risk. Thus, I feel that this global context is the most relevant to my project idea. The ideas I came up with are:-

1. Voice Controlled Wheelchairs

In today's world, the number of senior citizens and cases of below the waist problems (like paralysis, below waist fractures and ligament tears etc.) are increasing. Due to this, the usage of wheelchairs has skyrocketed over the past few years. Usually, the wheel chair is pushed by someone else while the patients can rest on the chair. What would happen if there is no one to push the chair? Patients who can freely move their arms are forced to rotate the wheels themselves in order to navigate, whilst the more expensive hospitals have started using wheelchairs where there is a joystick, connected to a motor near the wheels, which changes the direction of the motion of the wheel chair based on how the joystick is moved - this type of a wheel chair is usually given to full body paralysis patients. But this can be very

hard to control for a few, and in some cases, inaccurate. Instead, this idea is a voice-controlled wheelchair. There is a sound sensor, which is initialized before it is set - so the user has to initialize the sensor by saying the prompted words. This makes the change in direction easier rather than having the patients use their arms or head to navigate.

2. Space Debris Collector

With the increase in interest in extraterrestrial life or planetorial investigation, like Mangalyaan or curiosity, the amount of space debris has increased a lot. These scraps of metal which are considered “not a big deal” by many, is not true. The debris can possibly damage a certain satellite which could affect communication back at home. In order to prevent this threat of communication black out, I thought of a system which could collect space debris and bring it back to earth. Through this, not only are the chances of the blackout reduced but also the amount of pollution caused due to the extraction of metals. This system is a rover sized system, with an extra thick metallic layer - allowing the system to go through the earth’s atmosphere twice - and a storing chamber where the scraps of metal can be stored and back to earth. This metal that is brought back to earth, can be recycled and reused for other uses on planet earth.

3. Agriculture or garden monitoring drone

Current greenhouses and gardens have a huge dependency on man or human intervention for problems or growth of plants and man cannot watch over the planets all the time. Instead this system, which has drone flying over the lawn or garden with plants growing monitors the security of the lawn (prevents animal barging), the pest and chemical control, generates reports for all such factors and predicts the plant’s growth. So, the drone, sense the changes and sends a sort of notification to the main system server, which alters them. This system is more useful in the case of a school where in the land is closely monitored by the workers and there is a head who has access to a laptop

4. Blind man's eye

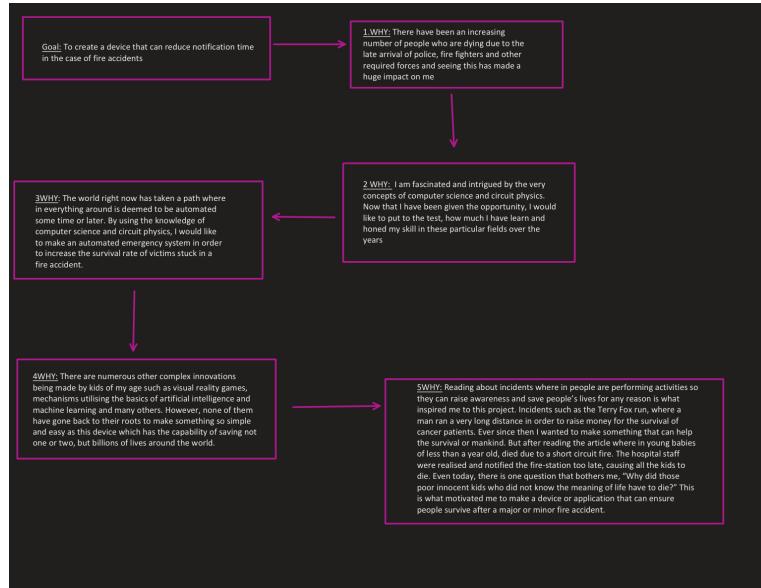
Blind people have a rather difficult time navigating through the streets and places because of numerous obstacles laid down on their path. They either need their stick or a guide. As for the stick, it might not be very efficient as they might not come in contact with the object always and the guide, well it is hard to have one by your side 24/7. Hence, the blind man's eye is a system which helps the blind man get a clear understanding of the surroundings and how far objects are from them. It has a database, which has the details of the rooms and objects in a certain place and based on where the person would like to go to, the system provides the best path and guides them through to avoid objects or people with the help of a camera or proximity sensor.

5. Auto-Dialing Emergency Alert System

Nowadays, fire accidents have become the most common form of accidents that people can experience nowadays. However, in spite of having the required technology and equipment to come out unharmed, there are people who still die. This is due to the delay of time whilst notifying the required forces: fire fighters, police, hospitals, and blood banks. In order to reduce this notification time, the auto dialing emergency alert system is the best device to solve this problem. It has a humidity and temperature sensors which detect the sudden drop in humidity and the sudden rise in temperature - which are caused during a fire. The values detected by them are compared to the threshold values, and based on that, the pre-programmed sim, using an auto-dialer software, calls the fire station, police and hospitals. This way, there won't be any delays in realizing there is a fire accident, there is no delay in notifying the forces, and people do not have to worry about carrying their phones out of the fire place and can focus more on saving their life and the lives of others around them.

After discussing with my supervisor, I was able to eliminate the most impractical and expensive solutions I proposed and narrow down to one solution: the emergency alert system. This helped me to focus my research and learning for the execution and efficient completion of the project. Although I did choose upon one of the many proposals I made, I wanted to understand for myself, why I am doing this project: was it just for grade, was it just for the

MYP certificate, did I genuinely want to help someone or did I want to hone my skill? What was the reason I planned on choosing the emergency alert system or the reason behind me proposing the other ideas? I tried to break this down using the 5-why chart, where in I asked myself “why?” five times, in order to arrive at a conclusive answer:



Once I was convinced as to why I wanted to do this project, I formed my goal. I made sure the goal was a SMARTC goal. This took a few attempts for me, in order to phrase and frame my goal the way it was supposed to be. Initially, my goal was very vague and had no specifications, defeating the purpose of the S in SMARTC, the next goal I was formed was too simplistic and did not meet the C expectation in SMARTC. Finally, after help and guidance from my mentor, I was able to frame a goal for myself:

GOAL: To make an automated device which reduces or prevents the harm and damage done by fire.		
Smart	<p>1. What do I want to accomplish here?</p> <p>2. Why do I want to accomplish this?</p> <ul style="list-style-type: none"> - I want to be able to create a device or application using the knowledge and skills I have polished over the years in the fields of computer science and circuit physics that can help save or better people's lives. Therefore I want to make an emergency alert system which can alert people and special forces quickly in the case of a fire accident, so the victims can be saved before it is too late. - Since first grade, I have been an active participant of social activities and club activities and helping people, seeing them smile, makes me smile as well. In fact, this year (academic year 2019 - 2020) I have started a computer science club or course where in I am teaching the IICS (Indus International Community School) students a few skills and impart my knowledge of computer science so they can achieve what they call "cool". Also, I am working near a slum where I am teaching children, of parents who are not able to afford education, how to read, write and speak English. Helping these kids who are in need, gives me a sense of happiness and satisfaction. Apart from that, seeing how innocent lives are lost due to no fault of theirs, motivated me to make this device. Recently, in an article I read "20 babies die due to short circuit fire". This news disturbed me a lot. Why did those kids who did not anything about life, die? The hospital staff realised there was a short circuit very late and by the time they informed the fire station, it was too late. 	<p>Measurable</p> <ol style="list-style-type: none"> 1. How will I measure my progress? 2. How will I know when the goal is accomplished? <ul style="list-style-type: none"> - I will measure my progress by using a journal, where in I note down all the activities I have done and post pictures on that showing what things regarding my project I finished. Apart from that, I will plan out my tasks or deadlines using a gantt chart and calendar. Based on how many tasks I finish and get approved by my supervisor, I will be able to measure my progress. Everything that I do in regards to my personal project, will be noted in a journal so I can see how much of the project I have finished. - I will know whether I have achieved my goal or not once the device I make provides the required output and takes the required inputs, in the actual environment - which would be simulated using household materials. <p>Achievable</p> <ol style="list-style-type: none"> 1. How can the goal be accomplished? 2. What are the logical steps I should take? <ul style="list-style-type: none"> - In order to achieve my goal, I need to plan out my task and organise myself. This organisation and planning of the tasks I have done with the help of the calendar and a gantt chart - wherein I not only decided upon the tasks, but also their respective deadlines. By doing this, I am more organised and can finish all the tasks by the intended deadline so I won't have to rush my personal project at the last moment. <p>Relevant</p> <ul style="list-style-type: none"> I personally feel that this goal is very relevant given the current scenario: fire accidents and deaths due to fires have become very common. With the development of technology, far beyond our imagination, fire accidents are viewed as simple by products as result of this quick development. It is because of this byproduct that many people have lost their lives, and many companies have lost many years of hard work. Therefore, I feel that this device is very relevant to our current world and for the future and it is the right time to be making this device.

Time-bound	The making of the device would take me anywhere from four to five months. In order to finish my work in a relaxed manner, I would commence the making of this device, latest by the month of September, 2019 and I aim on finishing it by the end of December, 2019
Challenging	Up until now, I have used my computer science or design knowledge during my design classes and my physics knowledge in my physics classes. Never have I inculcated the two disciplines to create something or achieve something. Due to which, I feel it would be very interesting and challenging to incorporate both disciplines in order to finish this project of mine.

Potential obstacles that I might face are:-

1. Time constraint - not only do I have to work on my personal project, but I also have to finish my school work, homework and the e-portfolios for my second language and design classes.
2. Lack of knowledge - there might be aspects where I might not know how to finish the task, and learning about that certain tool or feature might be a little difficult and time consuming given my lack of experience, knowledge and skill
3. Lack of resources - I might not have all the required tools and equipment to do a certain task for my personal project
4. Cost - there might be devices that are out of my budget and I cannot buy, thus making it a bit more difficult for I have to figure out an alternate method to achieve that certain functionality

People's whose help I'll need:-

1. My dad's help
2. My mentor's help
3. My physics teacher's help
4. I would require help from my lab professor(s) and the college students working at the lab

After I decided my goal, why I want to achieve it and what are the potential obstacles I would face through the journey of achieving it, I made my official goal statement, signed by my personal project mentor, for my personal project. This happened on the last meeting I had with my mentor for the academic year of 2018 - 2019.

ARTIV
13/6/2019

PERSONAL PROCESS JOURNAL	
GOAL SELECTION CHECKLIST	
<input checked="" type="checkbox"/> I have brainstormed and used mind mapping tools to identify my personal interest <input checked="" type="checkbox"/> I have documented my initial idea for my personal project in my process journal <input checked="" type="checkbox"/> I have taken feedback from my supervisor on these initial ideas to identify a goal for my project <input type="checkbox"/> I have identified my personal and SMART goal(s) to check the purpose of my goal and if it is highly challenging <input checked="" type="checkbox"/> I have written my goal as a complete sentence and checked if the goal achieves what I want to achieve through my personal project? a. What do I want to achieve through my personal project? <input checked="" type="checkbox"/> b. How will this goal help in making a significant impact on my stakeholders? <input checked="" type="checkbox"/> c. Have used my global context-opening and end-of-project to decide which global context aligns with my goal. <input checked="" type="checkbox"/> d. I have reviewed the statement of my goal if required to include phrases/words from my supervisor's feedback <input type="checkbox"/> e. I have documented why my Global context is relevant to my project in my process journal	
FINAL GOAL TO BE WRITTEN HERE AND SUPERVISOR APPROVAL SIGNATURE TO BE TAKEN	
<div style="border: 1px solid black; padding: 5px;"> To create an "Emergency Alert System" which would notify the police, hospital(s), fire station(s) or any other safety department when someone is in a "life and death situation" or in danger. This I would do so by connecting and directing my thinking with the help of the "16 Global Contexts", "Scientific and Technical Innovation" </div>	
Supervisor Signature - <u>Aplo</u> Date - <u>13/6/19</u>	

II. Identifying prior learning and subject-specific knowledge related to the project

Going through the objectives and requirements for the above-mentioned solutions, I was easily able to deduce that the skills and knowledge required by me for the completion of the desired product, all pertain to the field of computer science, or rather digital design, and physics. The process of making the product contains two parts namely programming and circuitry,

1. The circuitry part of the product, which is the first part in the making of the product, is an element of physics. Critical thinking skills, logical thinking skills and fine motor skills are all fundamentals of physics which every physicist must hone in order to grow in this particular field. The knowledge of what electrical component must be used when and where and how to and what are the best ways to connect a certain component into the critical or build a circuit are also part of physics, electrical physics to be more precise.

2. The programming part of the product, which is making of the brain of the design, is a part of digital design or computer science. The logical and creative thinking skills required in building the logical flow and backbone of the program, in the form of a flow chart or a pseudo code, and the critical thinking and analytical skills required in order to debug the program and understand where and why the displayed errors - if any - are occurring and what must be altered or what can be added to the program in order to make the product better and more efficient, are all skills introduced to me during my digital

design classes. The knowledge of pseudo codes and/or flow charts, programming languages - like python in this case - and program debugging are all concepts I learnt from my design classes.

After identifying the skills required, I constructed a KWL chart – the K stands for Know, W stands for Wonder and L stands for Learnt. This chart helped me understand my understanding and prior knowledge of the two disciplines and helped me gage as to how much I need to learn in order to make this project a success. In the K column, I entered all the concepts I already know and have a good grip on. In the W column, I entered all the concepts and skills I want to develop or learn through the course of this project. The L column I left it empty, for I planned on filling it once I complete my personal project, to see how much I had grown as a student and as an IB learner.

Know	Wonder	Learnt
Programming in python, C, C++, C# and Java	I want to learn a new programming language or a different application of the languages I've already learnt	<i>Will be filled</i>
Logical and critical analysis of a given scenario	I want to learn to be more patient and focused, especially when it comes to circuit building and/or program debugging	<i>Once the project</i>
Creative thinking to come up with creative and innovative ideas for a problem	Improve my communication skills	<i>Has been finished</i>

III. Demonstrating research skills

The table below summarizes the research I conducted. The research topic, the requirements and the reason behind that specific research have all been mentioned as well:-

Sl No.	Research topic	Source Type	Reason for research	Date of research
1	Arduino	Video	I realized that in order to make the device, the most basic thing required in order to automate everything was a microchip. Arduino is the most widely used microchip in the world that many people have and still used. So, I watched videos on how the Arduino works, what are the different types of it and what is the price range	20th of June, 2019
2	Raspberry Pi	Video and Website	After speaking to my friends, my dad and my cousin, it came to me that the Arduino is not an effective microchip to use in such a complex project. Instead the raspberry pi, which is an advanced and more modern version of the Arduino, is more compatible in such high scale and complex projects or devices. Thus, I decided to watch a few videos and read articles about the functions of the raspberry pi, how it differed from the Arduino, the different versions and their respective price ranges, and the extra plug ins (sensors and other external devices) I can add onto the raspberry pi.	8th August, 2019
3	Raspberry Pi setup	Video	Upon finalizing that I would be using the raspberry pi for my project, I started watching tutorial videos to gage an understanding as to what tools and skills I would require to work this microprocessor, especially what software tools I would require.	10th August, 2019

4	Raspberry Pi python	Videos, web links and tutorials	With the aim to begin start building the product as soon as possible, I decided to learn the things I did not know for this project. I started by learning the programming language, python, for the raspberry pi. This research I had to continue till the present day as learning the specifications for the raspberry pi were a little time taking, and there are new programming features that I can include with the release of the raspberry pi 4 - the latest raspberry pi - to make my device more effective. So, I planned on learning the logistics part of it alongside the other research and work I had to related to my personal project.	19th August,2019
5	Raspberry pi sensors	Videos, web links and manuals	After receiving the raspberry pi kit, I decided to start the circuit building almost immediately. Before which, I watched a few videos of how to connect the sensors and electrical components and who to program them, especially the temperature and humidity sensors	August 24th, 2019
6	Raspberry pi features and connectable device	Videos, wed links and tutorials	Although I had decided on using only the temperature and humidity sensors of the raspberry pi kit, I read more about the other sensors that can be connected, what external devices can be connected and how to program them. This gave me ideas to improve the current device that I was visualizing. This research I had to keep up till the present day as Raspberry Pi have started manufacturing new devices that are compatible with the newest raspberry pi which is the raspberry pi 4	September 10th, 2019
8	What are sensors and how do they work?	Weblinks	This was to get some background knowledge regarding sensors and how they work so I could program them quickly and easily. This also gave me information regarding the different types of sensors, which helped me decide which sensors are most apt for my device.	September 12th 2019

9	Sensors compatible with Arduino and how to calibrate them	Videos and weblinks	This was preparation for a back up plan, just in case the device does not work with raspberry pi. From this I learnt about the sensors that can be connected to the arduino and how they are calibrated to detect specific values.	September 16th 2019
10	Arduino Embedded C and C#	Videos	With the aim to have a backup plan I decided to learn things related to Arduino. I started by learning the programming language, embedded C and C#, for the Arduino. This research I had to continue till the present day as learning the specifications for the arduino was a little time taking. I planned on learning the logistics part of it alongside the other research and work I had to related to my personal project so I can develop the product further.	October 1st, 2019

The sources I used are:

1. <https://www.youtube.com/watch?v=UUOCh0Cby8>
2. <https://www.youtube.com/watch?v=aEnS0-Jy2vE>
3. <https://www.youtube.com/watch?v=j7LLVkPpQ78>
4. <https://www.amazon.in/Raspberry-Pi-Model-RASP-PI-3-Motherboard/dp/B01CD5VC92>
5. https://www.amazon.in/Elementz-Engineers-Guild-Pvt-Ltd/dp/B01MUNDXP6/ref=sr_1_2_sspa?adgrpid=57922142534&ext_vrn=hi&gclid=Cj0KCQjwrMHsBRCIARIIsAFgSeI0WJbN9089ZGE0ZsDI8X3dYG4lbFzzSiPgNKReGIIW7ZstlzJG0m1YaAqKEALw_wcB&hvadid=294103318260&hvdev=c&hvlocphy=9061998&hvnetw=g&hvpos=1t1&hvqmt=b&hvrad=16576908701718206168&hvtargid=aud-749174062446%3Akwd-298926499184&hyadcr=5875_1738708&keywords=raspberry+pi+3+sensor+kit&qid=1569779438&sr=8-2-spons&psc=1&spLa=ZW5jcnlwdGVkUXVhbGlmaWVyPUExUU9RVFhCTkMzS0M1JmVuY3J5cHRIZElkPUEwMTM2MzQ2Rk85UDE0MEVHRzBHJmVuY3J5cHRIZEFkSWQ9QTA0NDIxNzBOVUxFs1VMVEZFTk4md2lkZ2V0TmFtZT1zcF9hdGYmYWN0aW9uPWNsaWNrUmVkaXJIY3QmZG9Ob3RMb2dDbGljaz10cnV1

6. Bits, Byte My. "Raspberry Pi 4 Kit - Unboxing and Building." *YouTube*, YouTube, 6 Aug. 2019, www.youtube.com/watch?v=d-1dlwxSZHu&list=PLBkG7maypiFLUmBe3q3qc1X4bEmzJbf7N&index=8&t=0s.

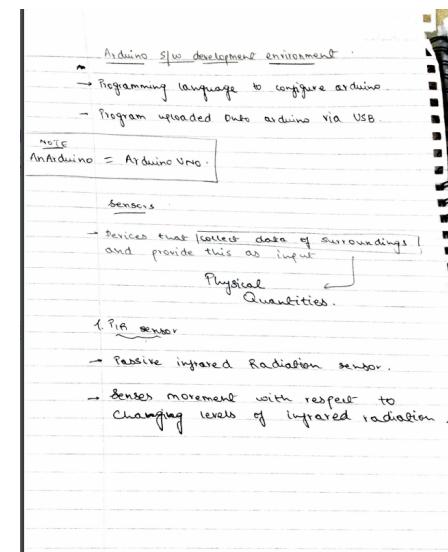
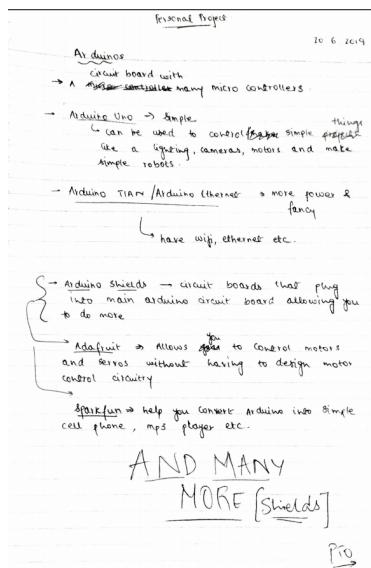
7. GreatScott! "Can a Raspberry Pi Be Used as an Arduino? || RPi GPIO Programming Guide 101." *YouTube*, YouTube, 6 May 2018, www.youtube.com/watch?v=tQEmtbaO2GY&list=PLBkG7maypiFLUmBe3q3qc1X4bEmzJbf7N&index=9&t=0s

8. Afrotechmods. "You Can Learn Arduino in 15 Minutes." *YouTube*, YouTube, 17 Mar. 2017, www.youtube.com/watch?v=nL34zDTPkcs&list=PLBkG7maypiFLUmBe3q3qc1X4bEmzJbf7N&index=2&t=0s.

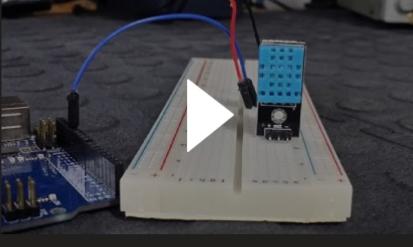
9. QRobotix. "Arduino Sensor Shield Overview." *YouTube*, YouTube, 10 Dec. 2016, www.youtube.com/watch?v=ZBEff-y9314&list=PLBkG7maypiFLUmBe3q3qc1X4bEmzJbf7N&index=3&t=0s.

10. Brainy-Bits. "DHT11 Temperature & Humidity Sensor with Arduino - Tutorial." *YouTube*, YouTube, 8 Jan. 2015, www.youtube.com/watch?v=OogldLc9uYc&list=PLBkG7maypiFLUmBe3q3qc1X4bEmzJbf7N&index=4&t=0s.

Here are a few snippets of my research:-



As you can see, I did use many websites in order to finish my research, however, one difficulty I faced whilst doing my research was deducing the validity of the source and how reliable and relevant it was for my project. There are many ways to determine a source's validity, but I used the CRAAP evaluation technique - CRAAP stands for Currency, Relevancy, Authority, Accuracy and Purpose. Here are two of my CRAAP evaluation sheets wherein I have evaluated two of my most important sources:

<u>Evaluation of sources</u>	<u>Source 1:</u> DHT11 Temperature & Humidity sensor with Arduino - Tutorial 	<u>Source 2</u> Can a Raspberry Pi be used as an Arduino? RPi GPIO Programming Guide 101 
Currency	<ul style="list-style-type: none"> - The link is functional - The information in the video is up to date and it does pertain to the latest version of the Arduino, thus making the source current enough for my project - Posted on: 8 January, 2015 	<ul style="list-style-type: none"> - The link is functional - The information in the video is up to date and pertains to the latest versions of the raspberry pi and Arduino, thus making the source current enough for my project - Posted on: 6 May, 2018
Relevancy	<ul style="list-style-type: none"> - The information is in depth and gives a clear explanation as to how the sensors work, how to connect them to the bread board and Arduino - I am comfortable citing this source 	<ul style="list-style-type: none"> - The information is in depth and gives an insight of the pros and cons of both microchips - I am comfortable citing this source
Authority	<ul style="list-style-type: none"> - Author: Brainy-Bits - The author's credentials are not mentioned, however author's youtube channel has 37.8 thousand subscribers, meaning the videos are viewed by many people 	<ul style="list-style-type: none"> - Author: GreatScott! - Author's credentials are not mentioned but the author's youtube channel has 1.22 million subscribers, meaning the videos are viewed by many people
Accuracy	<ul style="list-style-type: none"> - The information in this video can be verified from another source - The video is a tutorial, so there is no opinion portrayed. However, the author's method might be different when compared to other tutorials. 	<ul style="list-style-type: none"> - The information in this video can be verified from another source - The author mentions both pros and cons of both microchips, so there is no partiality or biased information being offered
Purpose	<ul style="list-style-type: none"> - The video has been made to teach - The author makes his intentions very clear by stating the purpose of the video in the beginning of the video and the name of the video 	<ul style="list-style-type: none"> - This video is made to teach, inform and answer a common question - The author makes his intentions very clear by stating the purpose of the video in the beginning of the video and the name of the video

Criterion B: Planning

I. Developing a success criterion for the product

In order to help me remember the requirements of the product to make it the best - in terms of efficiency and ease of usage - I created a success criterion which would not only show me the requirements of the product, but on a scale of 1-5 to what extent have I done justice to those requirements.

Criteria	1	2	3	4	5
<i>Working</i>					
Is the product executing the expected functions?					
The product provides the required output based on the input					
<i>Efficiency</i>					
Does the device make mistakes very often?					
Have there been device malfunction cases often?					
<i>User friendliness</i>					
Is the usage of the device easy to understand?					
<i>Compatibility</i>					
Is the device compatible in the field location you want to implement it in?					
Was setting up the device in the location hard?					

A score for each aspect is calculated by adding the scores given to the questions pertaining to that specific aspect. Then the total aggregate score is calculated by adding the scores of each individual aspect. If the aggregate score is 32 or greater, it means that the device is good, if it is greater than 25 to 32 then the device is good but needs to be improved. A score less than 25 means the device has many errors and faults and needs to be worked on.

Working = /10

Efficiency = /10

User friendliness = /5 **Total = / 35**

Compatibility = /10

In addition to this criterion, I have developed a few design specifications in order to help me streamline my thinking and stay focussed on my goal and project the entire time.

1. Aesthetics

- The product is a box with small holes to let the receiver part of each sensor to be exposed
- This way, the microcontroller or microprocessor being used will not get damaged by the flame and the sensors will be able to measure physical quantities and provide the system with inputs effectively

2. Cost

- Cost to sell has not been decided yet as I have not planned on selling my product
- The cost to make it is anywhere from 1500 to 6500 rupees based on the size of the microprocessor or microcontroller being used, the accuracy and features of the sensors being used and other factors

3. Customer

- The product will mostly be used in gated communities and highly populated buildings, so that the number of people harmed and the amount of property damaged will reduce
- The product will not be used by one single person but will be installed in one place and can serve to benefit and help numerous people

4. Environment

- The product will not pose any adverse effects on the environment, therefore it is eco-friendly
- The device can be repaired and each individual part of the device can be reused for another purpose by removing the soldering - the metallic connection of a wire or electrical component.

5. Size

- The device is relatively very small
- This small size makes its installation, storage and usage much easier for people
- The size of the device corresponds to the size of the microprocessor or microcontroller being used
- The efficiency of the device does increases as the size of the device increases.

This means that, as the size of the device increases it means that the size of the microcontroller or microprocessor being used increases. If the size of controller or processor increases, then the number of processes it can complete increases and the results are that much more better

6. Safety

- The device is extremely easy to use
- It can even be used by kids as young as 12 years
- The device does not pose any threat to the user, however the device may break if it is handled without care.
- The microcontroller (or the microprocessor) and the various other circuit parts are sharp at the bottom. This can cut someone if it is kept hanging or placed in the open. Instead, it has been sealed in a box so no one gets hurt

7. Function

- The device is meant to automatically notify the police, hospitals and fire stations, in the case of a fire
- The temperature and humidity sensors that have been connected to the device measure the relative temperature and humidity of the environment the device is placed in
- If the sensors detect a sudden drop in humidity and sudden rise in the temperature, it means there is a fire

8. Materials

- The hardware components being used are a DHT11 temperature sensor, a raspberry pi, jumper cables and a humidity sensor.
- The softwares I would require are the raspberry pi operating system, python and an autodialler software

II. Planning and recording the development process of the project

III. Demonstrating self-management skills

To finalize the project on time, time management is a crucial skill required by everybody. However, through the course of past incidents and actions, I realized my time management skills were a bit below the bar. Hoping to improve my time management skills, I used various methods to plan out tasks and adhere to deadlines.

I initially made a calendar wherein I wrote down the different tasks I would have to do on each day and how long each task would take. These tasks I uploaded onto excel, in order to create a Gantt chart, which helped me gain a clear understanding as to how many hours or days I would need to spend on a specific task of the project.

To record my progress of this project, I entered information as to what I did on that specific day in a diary, and in my process journal. The entries include the research I have conducted, the surveys or interviews I did and the entire planning as well.

Apart from strictly following the above-mentioned methods to stay organized, I arranged meetings with my personal project mentor and my lab professor, and updated them with all of my tasks that I had completed, tasks yet to be completed and the goals I set for the long run. This way, my lab professor, my mentor and I were on the same page, and my mentor and professor were able to provide me with more effective advices and guidelines for making the planning of the project a little easier for me.

Fig 2.1 is the calendar that I made, and Fig 2.2 is a Gantt chart I made in order to plan out my entire journey - from doing research, to making the device, to testing and determining its success. These plans and schedules were made based on the initial time schedule that I received during my meeting with my personal project mentor: initially, the implementation was meant to be finished by the end of November and in addition to that, I had to submit my

design e-portfolio in the month of February. Keeping all these submissions and deadlines in mind, I had planned out my personal project time. However, after the orientation and revised time table given by our school coordinator, I realized that I had another month to finish my implementation and the submission of my design e-portfolio was postponed till the month of March. I then revised my schedule and incorporated these changes into them and adjusted my external classes and coaching in accordance to those changes, so I can dedicate the most productive hours of my day to my personal project. Figures 2.3 and 2.4 are my revised calendar and Gantt charts respectively.

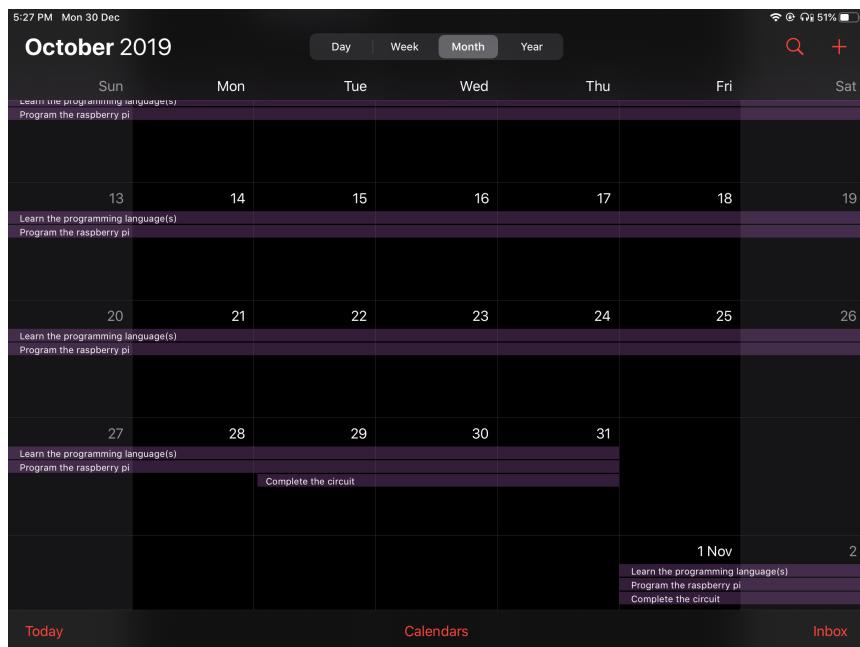


Fig 2.1

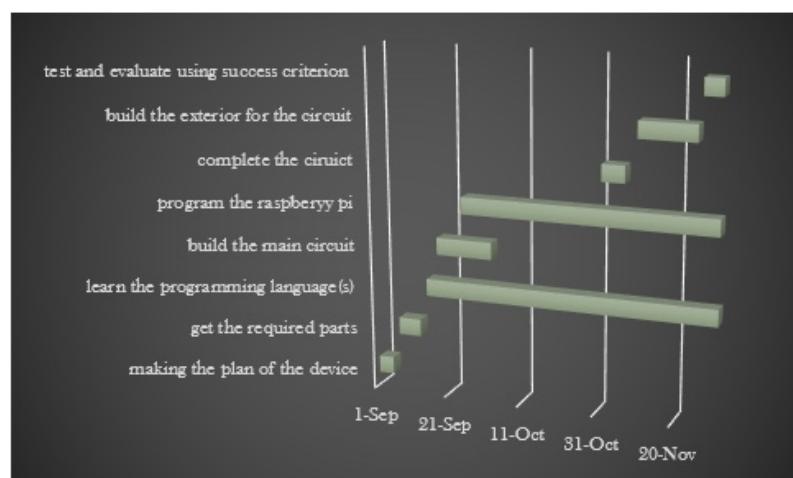


Fig 2.2

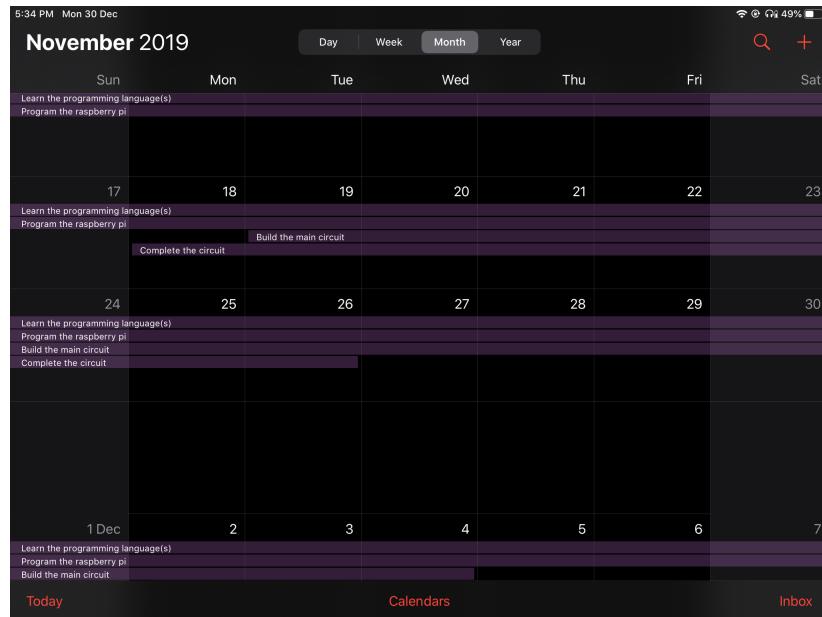


Fig 2.3

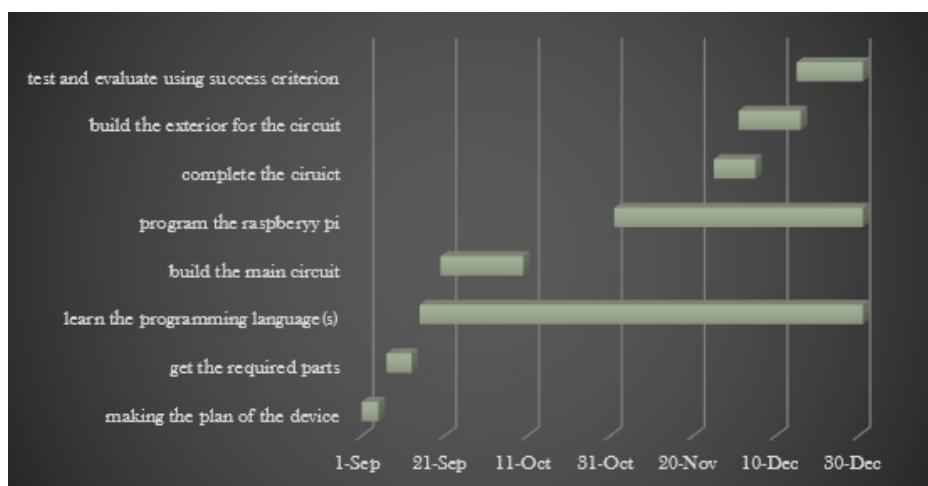


Fig2.4

Criterion C: Taking Action

I. Creating a Product

The device I have created helps me achieve my primary goal of trying to help people by integrating my knowledge and skills of physics and computer science. It also satisfies all the design specifications mentioned in the previous criteria. The device is entirely based on an Arduino microcontroller. There is a temperature sensor and a gas sensor attached to the Arduino microcontroller. When the temperature values and carbon dioxide volume rise above their respective threshold values - mentioned in the program - the GSM module that is attached to the Arduino sends multiple messages to the programmed numbers. The messages are sent by the GSM module until the fire is put out.

II. Demonstrating thinking skills

Through the course of the project, I have displayed and utilised my thinking skills time and time again, to produce the best outcome. Apart from instances highlighted in previous segments of this process journal, I used my thinking skills towards the end of the project, where I have introduced new changes to my device to increase its efficiency. Based on initial plans, I wanted to make my device using the new raspberry pi microprocessor, a temperature sensor, a humidity sensor and an autodialling software. However, as I worked on the device and did simultaneous research, I realised:

The humidity sensor slows down the time taken by the device to detect the fire as it takes a long time for the humidity in the room to change and it will not happen quickly until and unless there is a very big fire. However, by replacing this with a gas detector, the device can notify the forces quickly. This is because there is an instant release in carbon dioxide gas in the case of a fire accident - irrespective of its size. So by measuring or detecting the change in the volume of carbon dioxide gas in the room, the device will be able to conclude whether there is a fire or not quickly and notify the required forces immediately.

The temperature sensor I initially planned on using was the DHT11 which is a digital temperature sensor, compatible with the Arduino, that collects readings of

both temperature and relative humidity. It is extremely easy to use and program with a microcontroller, however, it can only measure temperatures within the range of 0 to 52 degrees Celsius. Instead of this sensor, I used the LM35 temperature sensor. This is a linear sensor which comes directly calibrated in degrees Celsius. The data readings is much more accurate than the DHT11 because the analog readings are directly proportional to the actual temperature. This sensor is also very easy to use and program with a microcontroller like the Arduino. Another benefit with using this sensor is that, it can measure temperature readings within a range of -55 to 150 degrees Celsius. This means that this sensor can measure very high temperatures, unlike the DHT11 sensor, making it more reliable in the case of a fire accident and fire alarm device.

I initially planned on using the raspberry pi microprocessor instead of a microcontroller like the Arduino. However, after interacting with my lab mentors and instructors, I learnt that the Arduino is much easier to handle and deal with, given its direct nature for both connecting external components and the programming. Raspberry pi is a microprocessor, or in other words a mini computer, which has its own operating system and is relatively harder to work with. Another advantage with the Arduino is that they have ethernet shields, and especially in my scenario, there area GSM shields available for the Arduino making the circuitry much easier and the device more compatible and portable - because it is smaller. By using the Arduino UNO microcontroller, it becomes easier for the users to repair or make any changes to the device as the things that have to be changed are the code - which can be changed easily by opening the Arduino IDE - and the circuitry.

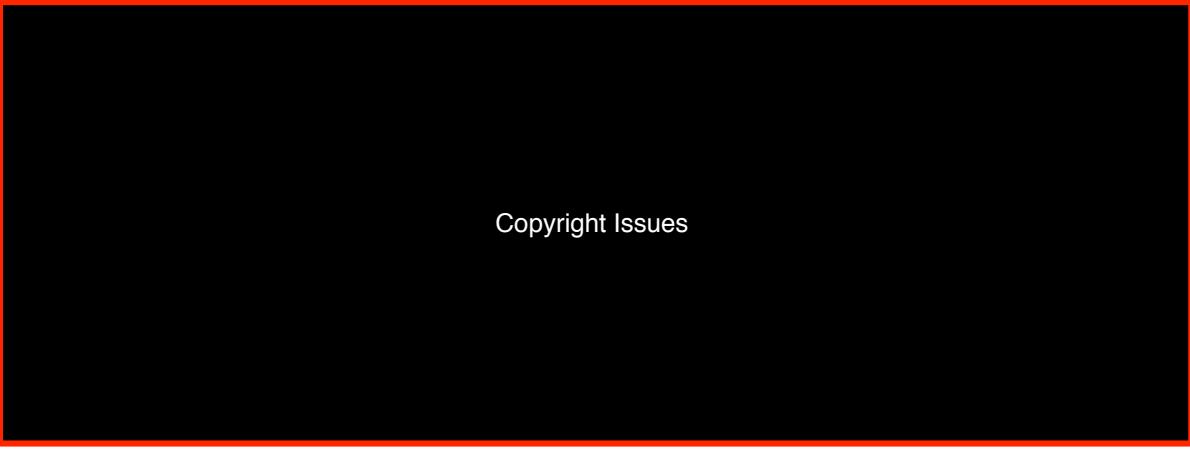
By incorporating these changes into my project, I was able to create a more reliable and effective device than the one which I visualised in the beginning of the project.

III. Demonstrating communication and social skills

Throughout this project, I was tested more on my communication and social skills than I was on other skills like my fine motor skills or self management skills. I had to communicate not only with my school assigned personal project mentor, but also with other

supervisors in my lab. This was the lab where I spent most of my time brainstorming and creating the device for my personal project. This lab is owned by a company known as “NovaTech Robo” which is a company that encourages and supports students interested in exploring the wonders in the field of designing and robotics. This is where I learnt more about 3D designing, microcontrollers and their respective sensors and how to code them. This is where I interacted with numerous specialists and obtained expert opinions, regarding my project ideas, and constructed my idea accordingly. In this journey of creating my device, I had to state my objectives, opine myself and share my ideas. All of this had to be done in a clear manner, in order to avoid any misunderstandings amongst us. This helped me develop my communication and social skills which are the most crucial skills required in any domain and any aspect in life.

Here are a few pictures of me working in the company lab:



Copyright Issues

Criteria D: Reflection

I. Evaluating the success of the product against its criteria

In order to evaluate the success of my product, I used the two IB testing methods: performance testing and field trials. In order to make this testing phase extremely effective, I have combined the two methods, wherein the device will be used in a simulated scenario - a scenario which mocks a real fire accident - and ask my mentors and friends to evaluate it using the success criterion that I had created in the previous section of this process journal.

Here are two of the marked success criterion:

Criteria	1	2	3	4	5
<i>Working</i>					
The product provides the required output based on the input				Y	
<i>Efficiency</i>					
Does the device make mistakes very often?				Y	
Have there been device malfunction cases very often?					Y
<i>User Friendliness</i>					
Is the usage of the device easy to understand?				Y	
<i>Compatibility</i>					
Is the device compatible in the field/location you want to implement it in?					Y
Is the device easy to set up?				Y	

Criteria	1	2	3	4	5
<i>Working</i>					
The product provides the required output based on the input				Y	
<i>Efficiency</i>					
Does the device make mistakes very often?					Y
Have there been device malfunction cases very often?				Y	
<i>User Friendliness</i>					
Is the usage of the device easy to understand?				Y	
<i>Compatibility</i>					
Is the device compatible in the field/location you want to implement it in?					Y
Is the device easy to set up?				Y	

II. Reflecting on how completing this project has extended my knowledge and understanding of the topics and global context

This ‘personal’ project, I chose to make an automatic emergency alert system. The making of this device required knowledge and skills that are used in the field of computer science and physics. This I feel I have played to my strengths, by focusing on the subjects that are my strengths. At first I thought there won’t be much change or development in my skills or knowledge. However, I thought wrong. This project was a platform which helped me understand myself more: I was able to obtain a clear understanding as to what are my strengths, my weaknesses, my likes, my dislikes and many other things. By understanding myself more, I am able to set long term goals and get a clear picture as to what I want to do in the future.

Although knowledge is an important need in the 21st century, character is equally significant. And this project has helped me mature and transform into a “leader of tomorrow.” My communication, collaboration and social skills, which are vital tools required for efficient team work, have developed when compared to how they were a few years ago. My fine motor skills have become ‘finer’ and I am able to perform more minute work, especially when it comes to circuitry. I am able to develop logical and creative solutions for a given problem as my creative, logical and analytical thinking skills have sharpened through the course of this project. Furthermore, I personally feel that my self management skills - which includes my time management and organisation skills - have improved. I finished all my project deadlines on time as planned, I was able to organise myself and the related files to make my work more clean and avoid confusion and scepticism. All of these are proofs to show that I have improved my self-management skills.

Here is a completed KWL chart, showing what I knew before the project, what I wanted to know before the project, and what I have learnt after completing the project:

Know	Wonder	Learnt
Programming in python, C, C++, C# and Java	I want to learn a new programming language or a different application of the languages I've already learnt	<i>A new application and form of C, known as embedded C</i>
Logical and critical analysis of a given scenario	I want to learn to be more patient and focused, especially when it comes to circuit building and/or program debugging	<i>New and efficient ways to build circuits other than the conventional circuits built using jumper cables and a breadboard</i>
Creative thinking to come up with creative and innovative ideas for a problem	Improve my communication skills	<i>How to effectively and logically analyse not only problems at hand, but also how to better a solution or understand what is wrong with the same</i>

III. Reflecting on your development as IB learners through the project

IB learner profiles are a set of ten characteristics that make someone, a true leader of tomorrow. Through the course of my personal project, I have grown a lot not only in terms of knowledge and character, but also as a leader. I have started using more IB learner profiles in my day to day basis than I did before, and this process journal is a culmination of all those profiles that I use daily. I started taking more risks and thinking of ideas that are more challenging for me or in a sphere that I am not very comfortable with, started to think more, critically, logically and creatively than ever before more sharply. All of this, is what I believe will not only help me finish my project, but will also help me grow as a all rounded human being and become a leader of tomorrow.

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