Emirates International School Jumeirah

Abdul Khurram's

Personal Project Process Journal

Topic:	
Goal:	The goal of this project is to create an interactive smart mirror, based on the C++ programming language.
Inquiry Question:	How can I use the C++ programming language to create a smart mirror?
Criteria:	
Supervisor Name:	Gengadharan Sengazhani

SUNDAY, 20 JANUARY 2019

Friday 7th December 2018

Work Completed This Week

I am now nearing the end of the development cycle of my product and am have mostly finalized everything. The only thing I had to do this week was to fine-tune the software and attach the wall mount to the back of this display. I have done both of those things, but as usual, I did run into some challenges.

Challenges/Difficulties Faced

While I was testing and fine-tuning the software on the mirror, I noticed something. The first thing was that the edges of the mirror, near the frame, were actually completely see-through. This was because the monitor was actually slightly smaller than the mirror, which is why the empty space was just transparent. This was easily fixed by super-gluing some black poster paper on the areas that were not covered by the monitor, this was a surprisingly elegant solution, as the paper blended in perfectly with the bezel of the monitor.

The second issue that I noticed was that the monitor produced a significant amount of backlight 'bleed'. Since this actually related to one of the student-designed criterion I created, this issue suddenly became a priority. Although it isn't perfect, I managed to create a 'band-aid solution' to the problem that fixed it to a certain extent. I did this by adjusting the colour saturation, contrast ratio and brightness of the display, which is a lot more difficult to adjust in a relatively small and unknown Linux distribution like this one, compared to an operating system like Windows. This problem wouldn't have been an issue if I had used and OLED panel for my display instead. However those are extremely rare and expensive, which make it less than ideal for this type of project.

Resources Consulted

N/A

Evaluation of Progress

I have completed everything that I set out do and am looking forward to presenting it to my supervisor and eventually everyone else, on the day of the exhibition.

SUNDAY, 20 JANUARY 2019

Friday 30th November 2018

Work Completed This Week

I eventually managed to successfully mount the raspberry pi to the back of the display and cable-manage all the excess wires to try to get the aesthetics of the final product to look as clean as possible, though this did come with some additional challenges.

Challenges/Difficulties Faced

Despite some more setbacks, this past week has still been quite productive. When I got to this stage of my product, I realized that there was a fatal flaw in my action plan. It didn't specify *how* exactly I was actually supposed to mount the raspberry pi to the back of the display. This is because I had just assumed it would be as simple as either sticking the pi using some electrical tape, or just by using some screws to hold the pi through the mounting holes on the corners of the PCB. However, due to several technical issues, neither of those options was actually feasible. This left me at an unlikely dilemma, eventually I managed to 3D print a mount for my specific model of raspberry pi and use that to mount it to the back of the display.

Resources Consulted

Thingiverse. 2016. Raspberry Pi 3 Mount. [ONLINE] Available at: https://www.thingiverse.com/thing:1590158. [Accessed 29 November 2018].

Evaluation of Progress

I am quite satisfied with how things are coming along and how I have persevered despite the challenges, this close to the due date.

SUNDAY, 20 JANUARY 2019

Thursday 22nd November 2018

Work Completed This Week

Although I've had some personal setbacks this week (read next section), I did manage to stay on track and get a fair amount of work done this week despite that, with the help of some of my family members. I completed a big chunk of the 'physical' aspect of my personal project this week. In summary, I managed to successfully replace the pre-installed glass in the frame with the two-way mirror, using a hot glue gun and some other adhesives. I also managed to mount the mirror and the frame to the display, using some extremely strong, double-sided mounting tape.

Challenges/Difficulties Faced

One major setback for me, not just in the personal project, is because of a recent injury. Earlier this week, I dislocated my right shoulder while playing basketball and will be unable to use my right arm for at least another month. I will not fully recover until at least 3-4 months later. This has significantly hampered my ability to build my product, which is why I asked some of my family members to help, and even affects my ability to type. I will try to not let this slow my progress too much regardless.

Resources Consulted

N/A

Evaluation of Progress

I am happy with the progress I have made so far, despite recent setbacks, and hope to continue at a steady pace in time for the deadline, which is on the 9th of December.

SUNDAY, 20 JANUARY 2019

Thursday 15th November 2018

Work Completed This Week

As expected, the last of my shipments arrived last week, which means that I can now finally start work on the physical version of my final product. As per my action plan, the first step to building the physical product was to connect the raspberry pi to the monitor, without mounting it to anything else, setting the operating system up, installing all the dependencies, installing the smart mirror software and making sure that all the necessary software worked as intended.

Challenges/Difficulties Faced

Once I had all that figured out, the next step was to rotate the software orientation of the display by 90 degrees, so that it could be in the correct orientation for a mirror. Unfortunately, Linux distributions don't usually have very comprehensive GUIs, which meant that I had to adjust every little detail, even menial things such as the brightness of the display, using the command-line or by manually

editing files in the filesystem. This wasn't much of a problem for me, since I am quite familiar with Linux in general, however it did slow things down quite a bit.

Resources Consulted

N/A

Evaluation of Progress

Although I have deviated from my original action plan (as explained in the previous journal entries) I am on track and should finish my product on time, if I keep working at this rate and if we don't run into too many unexpected issues.

WEDNESDAY, 16 JANUARY 2019

Raspberry Pi connected to display

Software installing on Raspberry Pi

Software running on Raspberry Pi in landscape orientation

Two-way mirror mounted inside frame

Display, with double-sided tape, connected to Raspberry Pi with software running in portrait orientation

Frame before mounting mirror (Image was taken from the product's Amazon page, because I had lost the original).

Two-way mirror before mounting into frame (Image was taken from the product's Amazon page, because I had lost the original).

Back of display, where mount screws need to be replaced

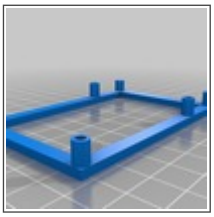
Mounting tools and screws

Sliders for mount with double-sided tape

Screws that need to be replaced on the back of monitor

New mounting screws on the back of the monitor

Sliders for mount on the back of the monitor



3D model for raspberry pi mount (model downloaded from site linked in appendix and sources).

Raspberry pi mounted on 3d printed mount.

Raspberry pi mounted on back of display.

Back of display after cable-management.

Second part of wall mount (this piece attaches to the wall).

Finished product (not mounted on wall)

WEDNESDAY, 24 OCTOBER 2018

Monday 22nd October 2018

Work Completed This Week

On the Tuesday the 16th of October, I attended, along with the entire grade, a three-hour personal project workshop. The workshop mainly consisted of us completing the Criteria A section of a self-evaluation sheet, along with an OPVL of all of the sources used thus far. I managed to complete most of this during the session at school, anything I did not complete at school was done at home. The self-evaluation sheet, along with the OPVL document has been sent to my supervisor, Mr. Ganga. I also managed to meet my supervisor during the session, we discussed how I have been progressing up till now, along with any other new developments or changes from the initial action plan. Aside from that, I have also placed my order for all the parts I need, I except the last shipment to arrive by the 2nd of November.

Challenges/Difficulties Faced

One challenge I faced during the personal project workshop was managing my time effectively so that I could get as much work done as possible during school hours. Since I didn't complete everything during the three-hour session, I would say that I could have done a better job at managing my time more effectively.

Resources Consulted

N/A

Evaluation of Progress

I am on track with the deadlines I have set for myself and hope that I receive all my shipments on time, to avoid further complications.

WEDNESDAY, 24 OCTOBER 2018

Monday 15th October 2018

Work Completed This Week

As I mentioned in the previous journal entry, I have carefully selected and finalized all of the parts I will need to build my mirror, except for the frame and the mounting method, which I have now also finalized. The list of additional items is as follows (links have been shortened):

- 12"x18" Black Frame- Souq Amazon Global Store US- https://goo.gl/pBDY73
- Fixed Wall Bracket- Souq- https://goo.gl/xMHG7r
- Scotch Double-Sided Mounting Tape- Ace Hardware

The mounting tape will be used to mount the display to the mirror or the frame, depending on what works best and the wall bracket will be used to mount the mirror on a wall so that it looks and functions more like an actual mirror.

Challenges/Difficulties Faced

The biggest challenge I faced this week was to find a way of mounting the display onto the mirror/frame, while also finding a way to mount it to a wall, all while retaining the look of a mirror.

Resources Consulted

Amazon. 2018. 12"x18" Black Frame Amazon Web-page. [ONLINE] Available at: https://uae.souq.com/ae-en/pinnacle-frames-and-accents-photo-frame-12-x-18-black-38159458/i/. [Accessed 15 October 2018].

Evaluation of Progress

I am satisfied with my progress thus far and hope to have ordered all the materials by the time I write my next journal entry.

WEDNESDAY, 24 OCTOBER 2018

Sunday 7th October 2018

Work Completed This Week

Although I don't plan on starting work on the physical product at least until the end of October, I took this week to start finalizing the items I will need, since I acknowledge that not all of the items necessary will be available locally in the UAE and that some items must be shipped from elsewhere. So far I have decided on everything except for the frame and any materials I may need to mount the display to the mirror/frame. I have compiled a list of everything I have decided thus far (links have been shortened):

- Two Way Mirror (12"x18")- Amazon- https://goo.gl/yvx416
- Raspberry Pi- Souq- https://goo.gl/P8QVcW
- 18 inch Display (HP V194)- Souq- https://goo.gl/iAjHXR
- VGA Female to HDMI Male Adapter- Souq- https://goo.gl/jLDnQy

I should have decided on a mounting method and a frame by the time I write my next journal entry.

Challenges/Difficulties Faced

One major challenge I faced this week was having to extrapolate and cross-reference, with other sources, any information I found relating to the dimensions of each of the products. This was especially important, for a project like mine, where the dimensions of each of the parts is absolutely critical to the success of the project. I can't have a display that is even a quarter of an inch bigger than the mirror, otherwise nothing will fit and I will be forced to scrap the entire project.

Resources Consulted

HP Customer Support. 2017. HP V194 18-inch Monitor - Specifications. [ONLINE] Available at: https://support.hp.com/emea_middle_east-en/document/c04997206. [Accessed 7 October 2018].

Amazon. 2017. HP V194 18-inch Monitor Amazon Page. [ONLINE] Available at: https://www.amazon.com/HP-V5E94AA-ABA-V194-18-5-IN/dp/B01DN0ELB2. [Accessed 7 October 2018].

Amazon. 2018. 12"x18" Acrylic Two-Way Mirror Amazon Page. [ONLINE] Available at: https://www.amazon.com/x18-Acrylic-See-Through-Mirror-3mm/dp/B07F7L519F/ref=pd_sbs_201_2?_encoding=UTF8&pd_rd_i=B07F7L519F&pd_rd_r=b893b8e3-d77e-11e8-943e-3f50e486d3b4&pd_rd_w=eiiak&pd_rd_wg dp-sims&pf_rd_m=ATVPDKIKX0DER&pf_rd_p=7d5d9c3c-5e01-44ac-97fd-261afd40b865&pf_rd_r=VP87ZNSZ4YF4VT6Y75R2&pf_rd_s=desktop dp-sims&pf_rd_t=40701&psc=1&refRID=VP87ZNSZ4YF4VT6Y75R2. [Accessed 7 October 2018].

Evaluation of Progress

I am satisfied with my progress thus far and hope to have all the materials finalized and ready to order before my next journal entry.

TUESDAY, 23 OCTOBER 2018

Sunday 30th September 2018

Work Completed This Week

I used this week to review and finalize some of the features and UI elements of my smart mirror. I have compiled a list of some of the main features:

- A clock
- A calendar
- A weather widget
- A news feed widget
- A stocks widget
- Options to add other third party widgets

The above list does not include all of the features of the smart mirror, but it sums it up pretty well. The aim of the smart mirror is not to be used as a computational device, but rather as a means to get all the basic information you need for the day, in an unobtrusive, easy-to-use and intuitive manner.

Challenges/Difficulties Faced

One challenge I faced this week was to decide and shortlist what information is necessary and what UI elements would clutter-up the user interface. This is especially challenging because different people have different definitions of what is considered 'essential' information, it can sometimes be difficult to identify what is generally considered 'essential'.

Resources Consulted

I did not need to refer to any sources for the work done this week.

Evaluation of Progress

I am satisfied with my progress thus far and hope to continue work on my project at a moderate pace.

TUESDAY, 23 OCTOBER 2018

Thursday 20th September 2018

Work Completed This Week

After a conscientious evaluation of each of the methods of user interaction, I have finally decided on one. I decided that because this was a smart mirror and not just a home computer that displays to a mirror, its primary function should be to display basic information, while still functioning as a mirror. For this reason I concluded that my choice didn't need to be something that user interacts with frequently, only that it is a fool-proof, reliable and simplistic way of interacting with the mirror, on the rare occasion that you would actually need to do so. After taking all of this into consideration, the only suitable device seemed to be the keyboard and mouse. The user wouldn't even need to use the keyboard and mouse on a regular basis, only when troubleshooting or adjusting a certain aspect of the mirror. Initially gesture controls seemed like a good option, but the complexity and cost to functionality ratio outweighed all the positives.

Resources Consulted

Tobias Weis. 2016. Smarter SmartMirror. [ONLINE] Available at: http://blog.tobias-weis.de/smarter-smartmirror/. [Accessed 5 September 2018].

Jon. 2018. How To: Make a Touch Enabled Smart Mirror. [ONLINE] Available at: https://www.magicmirrorcentral.com/magic-mirror-touch-screen/. [Accessed 5 September 2018].

Challenges/Difficulties Faced

The main challenge I faced this week was to accurately compare the pros and cons of each of the user interface devices, using reliable sources only.

Evaluation of Progress

I am satisfied with my progress thus far and hope to continue work on my project at a moderate pace.

TUESDAY, 23 OCTOBER 2018

Wednesday 5th September 2018

Work Completed This Week

After a meticulous re-evaluation of my action plan, I have come to the conclusion that it is not necessary to begin work on the physical product just yet and that I could produce a better final product if I took some extra time to carefully plan every little aspect of my product. One such aspect I have been looking into has been on the user interface side of things. I have yet to decide on a feasible method of interaction with the mirror. Some ideas I have been considering include:

- Gesture control (using a camera and hand tracking software)
- Touch controls (either using a capacitive layer above the actual mirror or by using a product like 'AirBar')
- Keyboard and mouse (easy to setup, more appropriate when there is limited user interaction, i.e. if the mirror is mostly used for checking the weather, news, time and other basic information)

I will decide on a user interface in my next journal entry and use this time to carefully evaluate each of the options' pros and cons.

Resources Consulted

Tobias Weis. 2016. Smarter SmartMirror. [ONLINE] Available at: http://blog.tobias-weis.de/smarter-smartmirror/. [Accessed 5 September 2018].

Jon. 2018. How To: Make a Touch Enabled Smart Mirror. [ONLINE] Available at: https://www.magicmirrorcentral.com/magic-mirror-touch-screen/. [Accessed 5 September 2018].

-. 2018. AirBar Webpage. [ONLINE] Available at: https://air.bar/. [Accessed 5 September 2018].

Challenges/Difficulties Faced

The main challenge I faced this week was making the decision to re-evaluate and revise my action plan, so that I can end up with an overall better and much a more refined final product.

Evaluation of Progress

As of now, I am satisfied with what I have achieved and hope to start work on the physical product sometime near the end of October or the beginning of November.

MONDAY, 15 OCTOBER 2018

Saturday 25th August 2018

Work Completed This Week

Until now, my main focus has been on making sure that the software side of things works and on developing the necessary software skills I need. This week, I shifted my focus to the actual physical hardware. Some things I decided on included:

- The dimensions of the wooden frame (12x18 or 18x24 inches)
- The dimensions of the mirror (12x18 inches or 18x24 inches)
- The dimensions of the monitor (12x18 inches or 18x24 inches)

At the moment I am more inclined to go for the smaller options, as they are cheaper and generally easier to build.

Resources Consulted

Aside from browsing online marketplaces, such as Souq and Amazon, I did not need to consult any resources for this stage of the project.

Challenges/Difficulties Faced

One challenge I faced at this stage was finding part that were all the same size and could fit each other, while also deciding on what size would be appropriate for a mirror.

Evaluation of Progress

I am pleased with my progress thus far and will hopefully stick to my action plan.

MONDAY, 15 OCTOBER 2018

https://www.theverge.com/circuitbreaker/2017/8/17/16158104/smart-mirror-diy-raspberry-pi-commute-weather-time-gadget

MONDAY, 15 OCTOBER 2018

Saturday 18th August 2018

Work Completed This Week

In order to ensure that the project is completed without any issues, I decided it would be best if I used this week to brush-up on some C++, just to refresh my knowledge a little bit. I didn't need to use any additional sources for this, since I just practiced by writing a few quick and simple programs in C++.

Resources Consulted

As stated in my previous journal entries, my main resource for my software is from an open-source GitHub project, which can be found here,

MichMich. 2016. MagicMirror. [ONLINE] Available at: https://github.com/MichMich/MagicMirror. [Accessed 16 June 2018].

In addition to this, I may also need to consult to an external guide, which can be found here,

Chaim Gartenberg. 2018. Building your own smart mirror is surprisingly easy. [ONLINE] Available at: https://www.theverge.com/circuitbreaker/2017/8/17/16158104/smart-mirror-diy-raspberry-pi-commute-weather-time-gadget. [Accessed 18 August 2018].

Bear in mind that I will most likely not need to refer back to this guide and will probably use my own, this is just a contingency plan.

Challenges/Difficulties Faced

Because I am still in the research and preparation phase of my personal project, I haven't really faced any real issues yet.

Evaluation of Progress

According to the deadlines set on my action plan, I am on track as of right now.

MONDAY, 18 JUNE 2018

https://github.com/MichMich/MagicMirror

MONDAY, 18 JUNE 2018

https://www.makeuseof.com/tag/6-best-raspberry-pi-smart-mirror-projects-weve-seen-far/

MONDAY, 18 JUNE 2018

Monday 18th June 2018

Work Completed This Week

I met with my personal project supervisor, Mr. Ganghadran, for the second time today. The topic of today's meeting was mainly to just come to an agreement about what I was going to achieve by the end of the summer holidays and a little bit about what kind of position that would leave me in afterwards. We created a brief outline of what the action plan should look like (Verbally) and agreed upon a few ground rules. Any and all code that I use for my project, that wasn't written by me, must be referenced, I should have most if not all of materials by the end of summer and that I should have also tested out some sample code, on a different display. Other than that, I did also manage to complete my action plan today.

Resources Consulted

One thing I did research was some frameworks for my smart mirror. I found an open-source GitHub project called 'Magic Mirror' which is fully modular and allows me to use the basic layout provided by someone else, but still use my own code to customize the interface as I please. I am considering this as an option to help me create my user interface. Here is the reference,

MichMich. 2016. MagicMirror. [ONLINE] Available at: https://github.com/MichMich/MagicMirror. [Accessed 16 June 2018].

Challenges/Difficulties Faced

I haven't faced any additional real challenges or difficulties so far; this is probably because I have mainly only been planning and researching at this stage.

Evaluation of Progress

According to the timetable provided in our personal project booklets, I should have met with my supervisor at least twice and created my action plan. I have done both those things; which I means I have successfully achieved all the goals initially set. It would have been even better if I had gone into more detail when creating my action plan.

MONDAY, 18 JUNE 2018

Thursday 7th June 2018

Work Completed This Week

Today I had my first meeting with my supervisor, Mr. Ganghadran, about my personal project. We discussed about how I was going to organize and manage my time effectively, so that I may allocate as much time as possible towards my other academic goals and responsibilities, while still managing to meet my deadlines for the personal project. We agreed that I should try to get as much work as possible done during the summer break, I should have at least acquired some materials and tested out some sample code on a test display by now. My action plan will reflect this.

Resources Consulted

As of now, the only research I have conducted has been at a website detailing some other pre-existing smart mirror projects. Here is the reference,

Mihir Patkhar. 2016. 6 Best Raspberry Pi Smart Mirror Projects We've Seen So Far. [ONLINE] Available at: https://www.makeuseof.com/tag/6-best-raspberry-pi-smart-mirror-projects-weve-seen-far/. [Accessed 7 June 2018].

Challenges/Difficulties Faced

Fortunately, I haven't really faced any challenges or difficulties yet, except for maybe when I initially had to choose an idea for my personal project. Shortlisting a feasible idea did take a considerable amount of time, but other than that, I have yet to face a challenge and/or difficulty.

Evaluation of Progress

By now I should have at least met with my supervisor once, which I have done and I should have also finalized what my product will be, as well as the materials and skills necessary to build said product. I should also have a brief idea of what I am meant to achieve over the summer, I have met all these goals. I probably should have conducted a little bit more research by now relating to the actual properties of the materials I will be using.