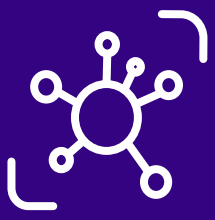


InfraVirus

Business Plan

April 7, 2020
BET 320

1.0 Executive Summary

1.1 Executive Summary

The COVID-19 pandemic has brought to light how woefully unprepared the world's infrastructure is to stop the spread of infectious diseases. Our product, InfraVirus, is an integrated virus detection system consisting of (1) Infrared Cameras (IR) (2) a user questionnaire (3) backend analytics software. The purpose of this product is two-fold; (1) to identify passengers with flu-like symptoms and notify authorities (2) to measure patterns across different countries for early pandemic detection. The market we are targeting is the infectious disease monitoring market and our preliminary customers will be all airports, where it will be installed as a precautionary tool.

1.2 Mission

To enhance global health through the early detection of viral infections.

2.0 The Opportunity

2.1 Problem

The COVID-19 pandemic refers to the widescale spread of a novel respiratory virus that has today infected 1.4 million people across 195 countries[1]. It has led to the immense loss of human life (81,000 deaths worldwide) and significantly stunted economic growth. Amongst the industries heavily impacted are the transportation and international travel industry. Air travel has been severely limited due to large-scale border closures and reducing passenger demand for flights. Airports have been heavily affected by these closures, as they are crucial for international travel.

There has been an increasing recognition of the dangers of a reactive approach to curbing the pandemic, and a shift towards precautionary measures such as social isolation and service closures to limit the exponential growth of the outbreak. In the

[1] Worldometer. (2020). COVID-19 Coronavirus Pandemic. Retrieved from: https://www.worldometers.info/coronavirus/

aftermath of COVID-19, governments are likely to focus on proactive approaches to limit the spread of infectious diseases, and airports are likely to implement preventative measures to regain the trust of their passengers and recover their huge economic losses. In many ways, COVID-19 has served as a "wake-up call" and shown the "the need for local, national and international pandemic preparedness plans" to better respond to the outbreak of infectious diseases in the future [2].

3.0 The Product

3.1 Product

InfraVirus is a virus detection system for proactively detecting infectious diseases in public spaces. InfraVirus has the following major components:

1. Infrared (IR) Cameras

Sensitive IR cameras measure the body temperature of passengers in the departure and arrival security checkpoints of the airport. These devices will only alert airport personnel in the case of an abnormal temperature reading. These are high-resolution devices that provide accurate skin-temperature readings on the faces and necks of people within the range of +/- 0.2 °C

2. Desktop Application

The desktop application is split up into several tabs for different uses, which are only displayed based on the user type: Administrators and Analysts.

2.1 User Questionnaire

If an abnormal body temperature is observed on a passenger, airport administrators will pull them aside for further questioning. The application provides a series of customizable questions related to age, gender, and travel destinations of the passenger's. The passengers name and precise address are

[2] Jackson, H. (2020, March 21). Coronavirus: Can Canadians expect another pandemic like COVID-19 in the future? Retrieved from https://globalnews.ca/news/6712312/coronavirus-outbreak-future-viruses/

not inputs into the system to retain passenger anonymity.

InfraVirus also provides the ability to alert the administrators if the survey results should lead to further testing, however, the testing of these passengers is left to the discretion of the airport and the local government.

2.2 Backend Analytics

This tab displays statistical information about the previously questioned users in the airport, such as the frequency of users with abnormal temperatures over time and clusters of similar users using t-SNE[3]. These are common statistical measures that provide analysts within an overview of the airport's safety. Further analysis can be performed by downloading the raw statistics, and using a provided Python library that facilitates the process for analysts and data scientists.

The data from an airport may optionally be uploaded to a fully encrypted server, so that local government analysts can identify large-scale patterns in the data. For these users, a large-scale machine learning model is used to identify potential viral outbreaks in a particular area and detect common underlying patterns in the symptoms experienced by these passengers.

3.3 Value proposition

For airports and governments who are dissatisfied with the lack of infectious disease prevention technologies currently being employed, our product is a proactive fever detection system for identifying and tracking viral infection spread, unlike the reactive approaches to detecting potential pandemics.

4.0 The Market

4.1 Market Analysis

COVID-19 belongs to a large family of viruses, including the Middle East Respiratory Syndrome Coronavirus (MERS-CoV) and Severe Acute Respiratory

[3] Maaten, L. V. D., & Hinton, G. (2008). Visualizing data using t-SNE. *Journal of machine learning research*, *9*(Nov), 2579-2605.

Syndrome Coronavirus (SARS-CoV), that have caused the outbreak of various respiratory diseases in humans. **InfraVirus is in the market of technologies that prevent the spread of such infectious diseases in public spaces.** Prior to the pandemic, this was a relatively small market of such technologies, however, with the spread of COVID-19, this market has seen rapid development.

There are various segments in this market including infectious disease surveillance/tracking technology, the infectious disease diagnostic market (anticipated to reach USD 25.43 billion by 2027[4]), the precautionary equipment market (wearables such as respirators, masks, gloves etc.), and the cleaning and delivery robot segment[5]. InfraVirus falls within the disease surveillance/tracking technology market that includes event based surveillance (e.g. Health Map), web based surveillance tools (e.g. Google Flu trends) , infectious disease modelling, and social media data analysis (e.g. Foodborne)[6].

During and after the COVID-19 pandemic, there will likely be a change in public behavior and a greater demand for such technologies to build public trust in public spaces. This trend is evidenced in the share price of Wuhan Guide Infrared (makes similar IR cameras) that has surged 85% since the start of this year[9].

Since this market is still in its preliminary stages, our solution will enjoy the first mover advantage through its technological leadership in the IR camera/image processing market, and through establishing high switching costs for our customers. High switching costs will be

[4] Markets and Markets. (n.d.). *Infectious disease diagnostics market*. Retrieved from: https://www.marketsandmarkets.com/PressReleases/infectious-disease-diagnostics.asp

[5] Chandran, R. (2020). *Here is house Asia is using tech to tackle COVID-19*. World Economic Forum. Retrieved from: https://www.weforum.org/agenda/2020/03/asia-technology-coronavirus-covid19-solutions

[6] Christaki, E. (2015). *New Technologies in predicting, preventing, and controlling infectious diseases*. Virulence. DOI: 10.1080/21505594.2015.1040975

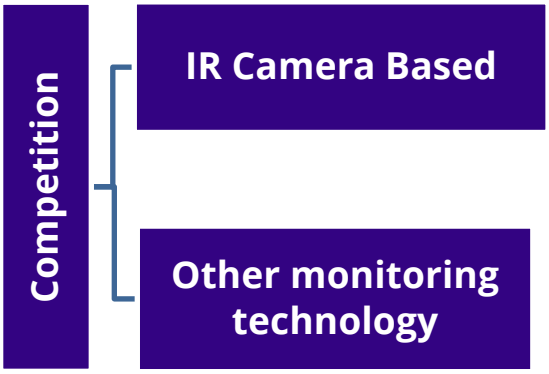
established through the installation fees associated with subscribing to the product, and the incompatibility of the hardware (cameras) with other analytics software. However, this advantage is likely to be short lived as it is a fast growing market with a fast pace of technological change.

An analysis of the market reveals that this market segment has moderate supplier and buyer power and low threat of substitutes and barriers to entry. It has moderate supplier power as while there are many IR camera suppliers and no one holds high bargaining power, there is a threat of backward integration from IR camera suppliers were they to develop similar analytics software. The market also has moderate buyer power as while there are a limited number of buyers (airports) and each buyer has high buyer power, there are high switching costs due to the infrastructure investment and compatibility of the infrastructure with other software. The product has a low threat of substitutes as other infectious disease prevention technologies are at least as expensive to implement. For example, alternative to monitoring technologies, airports would have to implement costly infrastructure changes such as adding terminal capacity and increasing space for waiting areas. Finally, there are low barriers to entry since there are limited capital costs (cameras), no need for economies of scale, no government regulations preventing entry, and little need for cumulative experience. Overall, this is an attractive market to enter.

4.2 Competition

There is **moderate competitive rivalry** in InfraVirus' market. There are two major types of competitors for InfraVirus; different technologies to monitor and map infectious diseases, and other IR camera-based fever screening systems. The first refers to technologies such as temperature screening robots deployed in public spaces that use image detection to alert authorities and Alibaba's new application that assigns green, yellow, red labels to

individuals depending on their risk level[7]. While these technologies are effective in monitoring the impact, since their use is very specific, they are likely only to be used during the course of this pandemic.



The second type of competition includes other makers of thermal imaging equipment that are selling fever screening systems. This includes companies such as Wuhan Guide Infrared, FLIR, Omnisense, and Infrared Cameras Inc[8]. These are relatively new companies with no one company having a large market share.

While our product is similar to these systems, it provides an added benefit of enhanced detection and analytics through the survey and backend machine learning software.

5.0 Our Customer

5.1 Customers

InfraVirus' target customers are the 43,983 airports around the world[9]. The air travel industry has seen positive growth in all but one of its last 15 years, from 1994 million in 2004 to 4540 million passengers in 2019[10]. This has been fueled by the increase of low-cost carriers, the growth of the middle class (especially in China and India), and the growth in airport infrastructure spending that has increased global carrying capacity[10].

[7] Atwell, C. (2020). New and Merging Tech to Combat the Coronavirus. EE Times. Retrieved from: https://www.eetimes.com/new-and-emerging-tech-to-combat-the-coronavirus/

[8] Bogaisky, J. (2020). Tech That Scans People For Fever In Big Demand Amid Coronavirus Crisis, Boosting Wuhan Company. Forbes. Retrieved from: https://www.forbes.com/sites/jeremybogaisky/2020/02/10/we-are-running-as-fast-as-we-can-coronavirus-sparks-surge-in-demand-for-infrared-fever-detection-equipment/?fbclid=IwAR3jtZNgV1UxKJISM47ReVtbz4f2NW0pK3_me9BvcmYoc0cPbtlZPbb16-c#708fba4b60c9

[9] Central Intelligence Agency. (n.d). *Country Comparison: Airports.* Retrieved from: https://www.cia.gov/library/publications/the-world-factbook/rankorder/2053rank.html

[10] Statista. (2020). Number of schedules passengers boarded by the global airline industry. Retrieved from: https://www.statista.com/statistics/564717/airline-industry-passenger-traffic-globally/

Airports are owned and operated through various types of public-private partnerships. For example, in Canada, airports are given on long term leases to non-profit airport authorities that are responsible for its operations and improvements[11].Thus, in Canada, our direct customer will be the airport authorities (e.g. Greater Toronto Airport Authority, TradePort International Corporation etc.).

Historically, air travel has been vulnerable to several external factors such as wars, terrorist attacks, and disease outbreaks. Figure 1 displays airport revenue trends and major international events.

The increasing flight cancellations, aircraft grounding, travel bans, and border closures stemming from the COIVD-19 pandemic have led to a dramatic and unprecedented decline in air traffic (projected reduction of 411 - 535 million passengers globally[12]) and proportional losses in revenue for airports. This loss is especially significant for smaller airports that have seen many flights rerouted and do not have large cash reserves[13].

Figure 1: Airport Revenues and Historic Events

[11] Parliament of Canada. (2017). Airport Governance Reform in Canada and Aboard. Retrieved form: https://lop.parl.ca/sites/PublicWebsite/default/en_CA/ResearchPublications/201717E

[12] ICAO. (2020). Effects of Novel Coronavirus (COVID-19) on Civil Aviation : Economic Impact Analysis.

[13] Roszell, T. (2020).New Brunswick airports to lose millions in revenue as a result of COVI-19 pandemic. Global News. Retrieved from: https://globalnews.ca/news/6770368/new-brunswick-airports-lose-millions-covid-19/

The recovery from this pandemic will depend both on government bailout measures and new technologies to build back passenger trust in air travel. Just as after 9/11, significant new visible airport technologies were implemented to enhance airport security, after COVID-19 there will have to be several changes to airport infrastructure and technologies to enhance health and safety. This includes infrastructure changes to enable physical distancing and reduce congestion such as larger terminals and larger spacing between seating areas and technological changes such as screenings upon entering the airport and pre-mapping the passenger experience such that passengers are assigned time slots for every airport process[14].

InfraVirus is one such preventative technology measure that may be adopted by airports looking to gain back public trust in air travel. It's key appeal over other infrastructure intensive interventions is that it is significantly less expensive. We recognize that airports are likely to be cash strapped in the near future, but are confident that the need to build public trust through disease tracking and mitigation will be a high priority. This technology may also be funded through supportive public agencies such as the Public Health Agency of Canada, Canada Border Services Agency and Canadian Air Transport Security Authority)[15].

Other possible customers for InfraVirus include any large gathering space such as schools, hotels, malls, and theatres. This customer was chosen due to their direct role in the spread of the virus, the likely health policy regulations stemming from this pandemic, and the devastating financial impacts they are facing.

[14] Gensler. (2020). Airports are facing a new reality. Retrieved from: https://www.gensler.com/research-insight/blog/airports-are-facing-a-new-reality

[15] Cison. (2020). Greater Toronto Airports Authority Responds to the Impact of COVID-19. Retrieved from: https://www.newswire.ca/news-releases/greater-toronto-airports-authority-responds-to-the-impact-of-covid-19-881762891.html

6.0 The Strategy

6.1 Strategy

InfraVirus' will begin by focusing on key airports and government stakeholders that were particularly affected by the COVID-19 virus and that the management team is familiar with as per the "crazy quilt" principle of effectuation. Hence, the team will begin by contacting Toronto Pearson Airport**,** the largest airport in the company's home country of Canada, and focus on creating a complete solution for this particular airport. InfraVirus will use a **beachhead strategy** to win over a single airport, allowing it to move on to larger markets from this initial effort.

As well, it is important to understand the job that needs to be performed by InfraVirus. In the emotionally-charged world following the COVID-19 pandemic, it is of utmost importance to understand how all the various stakeholders: governments, airports, airlines and travelers, were affected by the virus, and to see whether the solution fully assuages the fears of these stakeholders. Hence, along with the beachhead approach at Toronto Pearson Airport, InfraVirus will continue to perform **primary research** and evaluate whether the solution fully performs the job of mitigating future pandemics and providing assurance for the various stakeholders.

Lastly, InfraVirus provides a proactive solution for detecting infectious disease spreads in a high-risk environment. The existing solutions for screening people through IR cameras are reactive, and do not emphasize prevention and long-term information gathering through an integrated software system. As described by Porter's generic strategies, the narrow focus on the airport setting and the proactive approach to pandemic prevention describes the overall strategy of InfraVirus as a **differentiation focus strategy**. This permits higher prices to be charged for the product.

6.2 Competitive Advantage:

Competitive Advantage	Comment
Technology	InfraVirus' software platform for tracking pandemics is a powerful tool for its major customers, especially national governments, since they have the ability to view trends that can prevent potential outbreaks. Evidently, this is a highly valuable resource for customers and is rare due to its reliance on software and data expertise.
History	Due to the ongoing fight against Covid-19, the stakeholders' awareness of the cost of a pandemic is very high. Later entrants into the market will not benefit from the awareness surrounding the problem at the current state, making the barrier to entry much higher due to the difficulty in imitating the state of the world at the time of our company's entrance into the market.
Relationships	By focusing on airports and exploiting the increased awareness surrounding Covid-19, we plan to build strong relationships with governments and airports to reduce our competitors access to distribution channels. These relationships are valuable, as governments can create policies for legally enforcing the use of pandemic prevention devices, such as the ones provided by our company. These partnerships will also aid with widespread adoption with new clients. As well, there are high switching costs due to the physical infrared devices that we are installing and the difficulty in re-training personnel for a new platform. Hence, it is difficult for competitors to imitate this valuable resource.
Focus	The focus on airports for the target setting allows us to create a solution that is tailored for this environment, and can fulfill the desired job in the jobs-to-be-done theory in a more complete manner than competitors, such as the manufacturers of IR cameras.
Experience	Our company's experience in a wide-range of domains, especially in technology and consulting will allow us to quickly adapt our technology to fit the clients' needs. This is a competitive advantage over the incumbents within this domain, who typically have manufacturing backgrounds that are less likely to create a complete solution for a focused setting.

6.3 Risk Factors

InfraVirus relies heavily on **sales to airport authorities** and the stakeholders' awareness of the vast potential costs of an epidemic. This risk can be mitigated through a marketing strategy that will target airports that most acutely affected by COVID-19 to raise awareness about future risks.

As well, **government regulations** can play an important role in the adoption of InfraVirus, and our business must be flexible to respond to changing laws. This flexibility is provided by our selected business model, Hardware-as-a-Service (HaaS). It is also important to maintain public awareness of infectious diseases after COVID-19, so that they may lobby for policy changes related to airport safety concerning epidemics.

Lastly, our solution relies on fever detection through IR cameras, a symptom which may not hold true for all future epidemics. This is mitigated by our business model (the HaaS model) that allows for us to be flexible and adapt to **potential new symptoms** from a different virus. Our solution does not consider screening asymptotic travelers, however, it is a powerful and efficient screening technique for large groups of travelers.

6.5 Business Model

InfraVirus will operate as a **Hardware-as-a-Service (HaaS) company**, with an initial installation fee for the IR cameras, and annual contractual fees for the iR cameras and desktop software to be used. Since our product is proactive in preventing future pandemics, it is essential for our technology to evolve with new innovations and research, which can be achieved through this business model. As well, the lower upfront capital cost will increase adoption by airports and will fulfill the entire job of preventing infectious disease spread for the airport, as outlined by the job-to-be-done theory.

Our business model differs from the traditional security systems used in airports, which often have separate suppliers for the installed security cameras (various brands)[16] and overarching software component. Our business model involves includes both new cameras and the supporting software to provide an end-to-end solution for airports, rather than a partial solution.

Lastly, with the HaaS business model, it is essential for the customer to perceive the benefit of the installed product to have a long-term partnership, and to reap long-term value from the customer. Since epidemic outbreaks have not been extremely common historically, it is important that we communicate with the local governments, as they have the power to mandate the use of disease tracking technology after COVID-19. As well, the desktop software will provide powerful metrics to the customer, so that the power of InfraVirus is perceptible to the customer. These two tactics will mitigate the risk of airports cancelling their annual subscription, and make our business model feasible as a long-term solution post COVID-19.

7.0 People

7.1 Management Team

The management team consists of four experienced members in the fields of engineering and consulting: Siya Agarwal, Alexandre Doubov, Junaid Siddiqui and Eunice Gichuhi.

Siya Agarwal

Siya will lead business development and financing for InfraVirus. She is experienced in project management, sponsorship procurement, and financial modelling, and has served as the business lead in multiple entrepreneurship competitions including the Hult Prize and Hack the Globe. Her

[16] Airports. (n.d.). Retrieved from https://www.genetec.com/solutions/industries/airports

analytical skills and business acumen will be vital in building industry partnerships.

Alexandre Doubov

Alexandre will manage the software and machine learning teams for InfraVirus. He is an experienced software developer and machine learning researcher, with previous experience at Uber and Intel. This background will be key for developing a strong software platform that can be used for large-scale data analysis in the prevention of pandemics.

Junaid Siddiqui

Junaid will manage hardware design and connect with the software team to optimize the InfraVirus system. He is experienced in designing hardware for sensor-applications and is experienced in interfacing them with software systems through experiences in both industry and academia. This field of expertise will be crucial in ensuring the software and hardware are compatible for seamless functionality.

Eunice Gichuhi

Eunice will manage marketing and customer relations. Eunice has participated in DECA, a business competition, at a provincial level and talked at City Hall. As a founder of Aminia Organization, Eunice has first-hand exposure to customer relations, business analysis, and marketing strategies. This experience will be key in the growth of InfraVirus.

7.2 Stakeholders and Partners

For InfraVirus, the key stakeholders are governments, airports, airlines, and airport travelers. Governments are highly motivated to prevent future endemics in the wake of COVID-19 as these have a devastating effect on the health of their citizens and the economy. In the United States, the COVID-19 pandemic has resulted in 12,000 deaths and driven the government to sign a $2 Trillion stimulus plan.[17]

[17]Pramuk, J. (2020, March 31). Trump calls for $2 trillion infrastructure package as part of coronavirus response. Retrieved from: https://www.cnbc.com/2020/03/31/coronavirus-stimulus-trump-calls-for-2-trillion-infrastructure-plan.html

Airports are also invested in the future prevention of pandemics, as national borders were quickly shut down across the world during the COVID-19[18]. For both, publicly and privately owned airports, these shutdowns can be a huge detriment to their business and profit. For example, Hong Kong's airport contributes 5% to the GDP of the country[19]. Airlines are similarly economically affected by flight restrictions that can result from the onset of pandemics, and they suffered huge losses during COVID-19, losing $252 Billion in revenue during the virus[20]. These huge economic losses incentivize airlines and airports to incorporate preventative safety measures for mitigating future pandemics.

Lastly, travelers are stakeholders, as they would be screened by the technology and are potential carriers of new diseases. InfraVirus' task in preventing future pandemics would benefit enormously from the support of travelers, who could encourage governmental change. Travelers may also experience a sense of responsibility after seeing the devastation caused by COVID-19, and will be more willing to cooperate with this new screening technology as it can prevent them from being unwitting carriers of a deadly flu. The survey questions conducted and processed by InfraVirus can only provide meaningful results for policy changes if travelers understand that their answers (in a non-pandemic setting) are anonymous and will not be used for restricting their travel. Increased passenger cooperation can be gained by being transparent about the use of the survey results and by making the screening process as painless and efficient as possible.

[18] Salcedo, A., & Cherelus, G. (2020, March 15). Coronavirus Travel Restrictions, Across the Globe. Retrieved from https://www.nytimes.com/article/coronavirus-travel-restrictions.html

[19] Pham, S., & He, L. (2019, August 13). Hong Kong airport shutdown: What it means for business and the economy. Retrieved from https://www.cnn.com/2019/08/12/business/hong-kong-business-airport-closure/index.html

[20] Garcia, M. (2020, March 24). Airlines Face $252 Billion In Revenue Losses From Coronavirus, Swift Action On Bailouts Critical To Prevent Failures, IATA Says. Retrieved from https://www.forbes.com/sites/marisagarcia/2020/03/24/as-airlines-face-252-billion-revenue-loses-swift-government-action-becomes-critical/#27228c781447