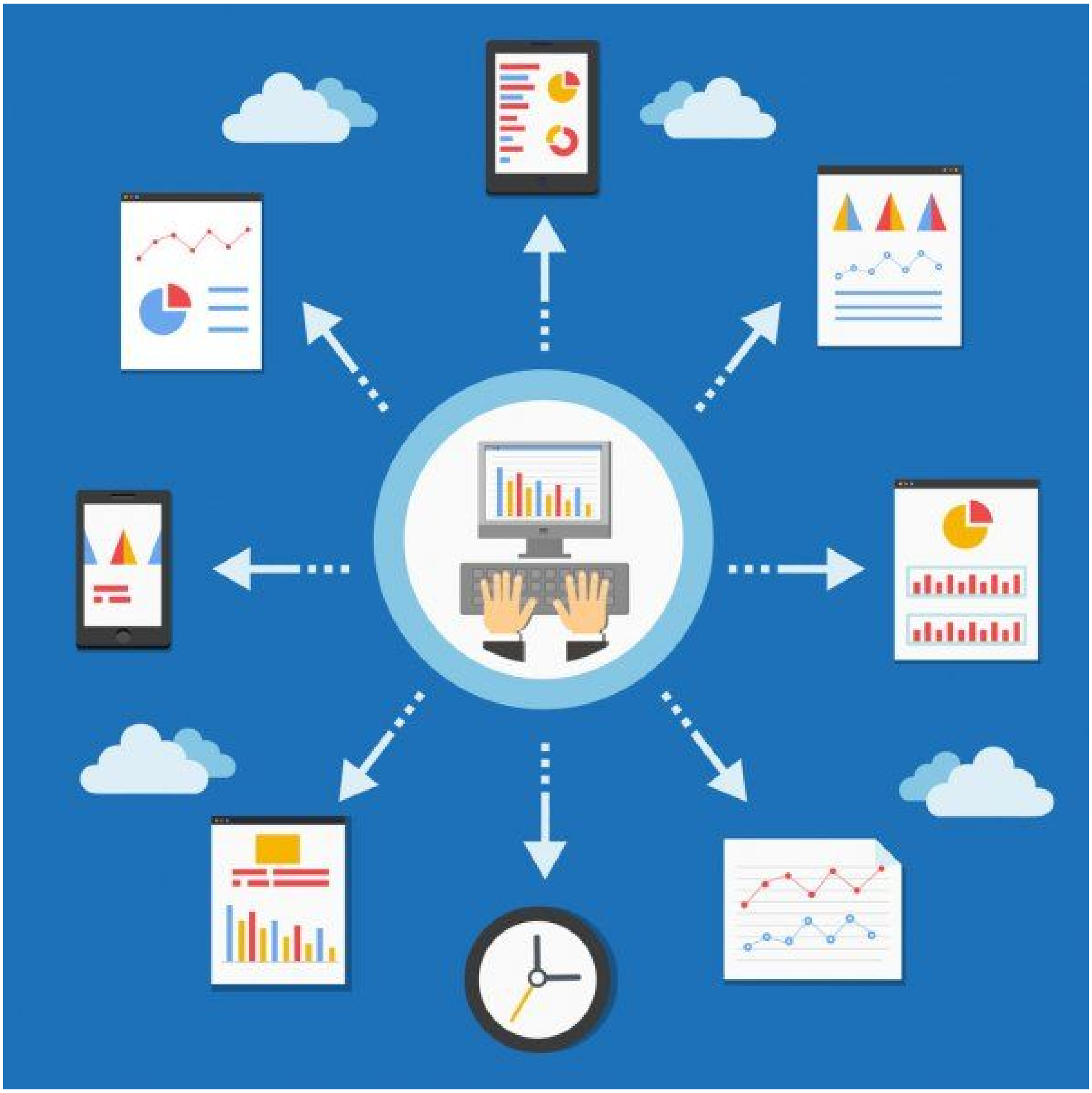
Computerised Pandemic Control and Management Support System



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1.1 Executive Summary

The Pandemic Control and Management Support (PCMS) is an initiative for proffering better emergency response mechanisms during pandemic situations. This paper has considered the old system, the current system, and the new envisaged system. The computerised perspective to advancing the current system has been considered while favouring a cloud-based approach. The methodology for such a computing architecture is also reviewed. On the whole, a comprehensive review of the issues and problems inherent in the existing and future orders is also examined. The paper is only a preamble to other segments of an entire PCMS project for a hypothetical two-year duration. The scope for this project will be outlined utilising a structured scope breakdown sequence detailing the projects charters, the goal for the project, its deliverables and characteristics to be delivered and what metrics to consider the project a success.

Furthermore, the project's inherent benefits will be discussed and what means and stakeholders are required to realise these benefits. The stakeholder and communication processes will be detailed in their respective components, and the overall project management process will be discussed from initiating, planning, executing, monitoring and controlling and closing.

Lastly, the risks associated with the project will be detailed, a detailed risk management plan will be discussed with the significant dangers discussed, their likelihood and impact and methods to handle them, as well as details of risk analysis techniques to perform. Ultimately, overall project recommendations will be given.

1.2 Introduction

A pandemic is the outbreak of a deadly disease that spreads to and infects people so fast that it becomes prevalent over a whole country or the world before vaccine administration. The criticality of a pandemic is such that governments and health institutions across the globe are usually handicapped until a vaccine is discovered. Efforts to mitigate the effects of a plague at the early stage have necessitated the need for a computerised Pandemic Control and Management Support (PCMS) system.

The hypothetical PCMS system being considered is a typical two-year project to design, research, and produce a support system for aiding either the government or the citizens with comprehensive pandemic data. These data shall include, amongst other things, the pandemic origin and biological family, the demographic distribution of those infected, etc. They shall also have warning signs, advice, and necessary care arrangement for the citizens.

However, when considering such a system and associated incidental costs, serious attention must be given to the computing architecture and resources required to drive the scheme. Typical questions might include: should the system preference be based on bare-metal systems or co-located systems that will inevitably involve the upfront acquisition of and investment in hardware and software? Or, better still, a system that makes possible the adoption of a system architecture that makes possible the payment for computing resources on a per-use case basis? Cloud computing resources are ideal for a PCMS project because they make possible location-independent facilities that are also affordable.

1.3 The Purpose of the Project

The PCMS will serve the purpose of an emergency response initiative that effectively equips health care experts with all necessary information for proactive measures. This is because, so far, pandemic influenza has posed a significant global health hazard to governments all over the world. Based on the PCMS and other similar initiatives, the Australian government and the broader Australian health sector, for example, is strategically equipped for emergency response pandemic influenza crises. The current COVID-19 pandemic experienced all over the world, which broke out in China, has defied all measures because of non-viable PCMS programs adaptable to COVID-19 influenza.

1.3.1 The Issues

According to Alexander Capron of the University of Southern California, a variety of ethical approaches to pandemic planning needs to be examined in terms of both the content of policies to be applied and the processes by which they are established and implemented (Timpka T, 2011). Answers must be provided to questions including What are the implications of pandemic influenza for human rights? How can unhindered access to health care be guaranteed? What are the obligations of and to healthcare workers? What responsibilities should the masses expect from their countries and inter-governmental organisations? Under a PCMS initiative, these issues need to be adequately addressed, and policy paper(s) articulated anticipatory to the onset of pandemics (WHO, 2007). A vital problem in pandemic management is about handling preference or priority of who gets healthcare attention first. Should the old and sickly go first or the security officials or the primary healthcare providers or the privileged or the leaders?

1.3.2 The Benefits

Because global pandemic influenza will affect every country, the government needs a standardised and coordinated approach to international information dissemination that is essential for effective crisis management at international levels (WHO 2009). Thus, the benefits of a robust computerised PCMS system consist of readily available and shareable information at a national and global level.

With a computerised pandemic control and management system, an undisrupted flow and collection of intelligence courtesy of individual countries will reinforce a global assessment of the situation. Any misinformation or lack of information at all levels will facilitate the unnecessary loss of lives, inadequate resource allocation, spread of damaging rumours, and ultimately misdirected efforts.

1.3.3 The Methodology

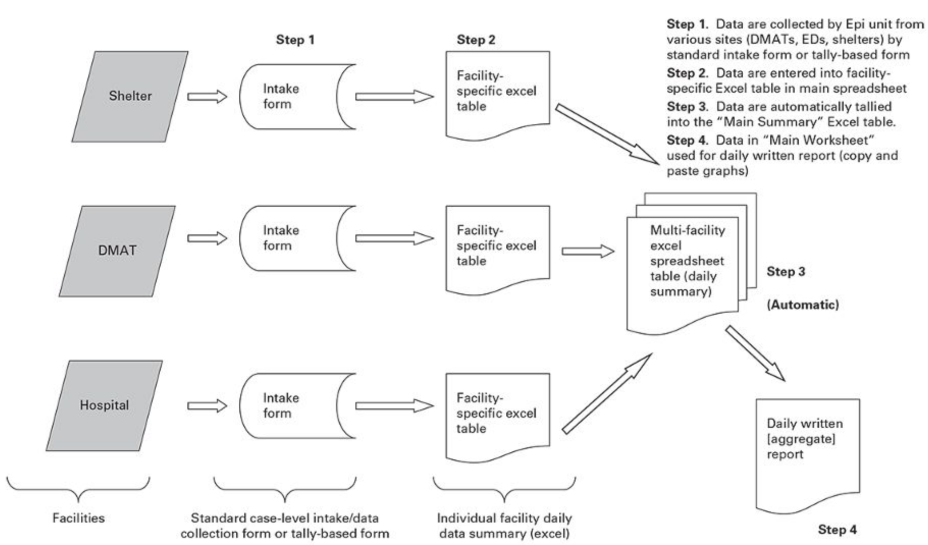
Viable methods for successful emergency response campaigns against pandemics are such that they must leverage technology. This is because technologies and surveillance systems are integral and continuously evolving to bolster the support of public health in response to outbreaks or some other public health scenarios. Only technologies and surveillance systems that are pervasive and cost-friendly will present viable options for situational awareness, early event detection, enhanced surveillance, identification and management of exposed persons, response monitoring, etc. Thus, it has been concluded that only cloud-based simulation architecture shall satisfy the above for pandemic influenza simulation (Lye DC, 2009). This is because cloud-based solutions are scalable, accessible from any part of the world, and are flexible to accommodate cost requirements.

1.3.4 Cloud Computing Platforms and the Google Cloud Platform

Although many cloud platforms exist commercially, such as Amazon E2, Microsoft Azure, etc., the Google Cloud Platform (GCP) shall be embraced here. The GCP option is as a result of Google's leading research roles in the use of containerisation techniques, Kubernetes engine, data analytics, big data, and ML for handling complex data structures of geometrical proportions simultaneously from different parts of the world (WHA, 2005). In simulating pandemic situations, a good practice shall be to explore short-term rental of virtual machines based on use cases and owing to the need for either scaling up or down of execution resources during ongoing outbreaks. Additionally, regardless of the adopted choice, there is also the liberty to pay for time slices regarding services and resources without the need for huge upfront capital investments on hardware and software acquisition.

With internet-based cloud surveillance, activities are event-based rather than the traditional passive types that rely on routine reporting by healthcare systems (WHO, 2007). Also, with the advancement in computing technology and software engineering, methodologies for wide epidemic and pandemic simulations have become possible.

A sample cloud-facilitated case management scenario for epidemic and pandemic event measurement, monitoring, storage, and retrieval architecture is as shown in the diagram below.



Source: Florida Department of Health, Bureau of Epidemiology. County health department epidemiology hurricane response toolkit. Updated April 20, 2015, p. 19.

1.4 Recommendations

Based on documented trending of pandemic influenza scenarios, the following action points are now recommended:

Planning and Coordination - This takes care of envisaging the leadership and coordination of events necessary across regions.

Situation Monitoring and Assessment - In this scenario, information and data regarding the pandemic risks before occurrence are collected, interpreted, and disseminated to monitor the pandemic characteristics.

Reducing the Spread of Disease - This refers to concerted efforts required to checkmate rapid and uncontrollable spreading of the disease through the enforcement of "social distancing" as well as inter and intra-city or international lockdown measures.

Continuity of Health-care Provision - Planning for the responsive building of isolation centres in proportion to the escalation of the pandemic is necessary.

Communications - On-the-spot monitoring and reporting of the exact situations from different regions through effective communications cannot be overemphasised. This will enhance informed decisions and appropriate actions from healthcare service providers.

1.5 The Current PCMS System

Current Pandemic Control and Monitoring Systems cannot be said to have explored entirely proactive behaviours in terms of rapid responsiveness to spreads and enabling technologies such as cloud hosting. The COVID-19 pandemic is an alarming case in hand. The COVID-19 virus has exposed the weakness of humanity's technology, research, and science in swift and practised response. Who would have thought that China, the US, Italy, the UK, Iran, and a host of other advanced societies would be the worst hit at this time? While some schools of thought may readily churn out conspiracy theories behind the COVID-19 emergence, the one thing that stands out is the fact that hitherto pandemic control and management support systems are heavily flawed and would require urgent overhauling.

Several issues can be spotted in the current PCMS system. For example, why was there no predictive model for anticipating situations like this with appropriate response measures? Why must it take the world this long without yet discovering a COVID-19 vaccine? Could there be paranormal reasons for the outbreak of this pandemic? Considering the antecedents and life cycles of COVID-19 predecessors such as SARs and Ebola, what are we expecting with the present strain of the coronavirus? What sort of intervention is required to beef up the capacities of the healthcare practitioners both to protect themselves as well as the society adequately?

With news reports from all over the world, the COVID-19 pandemic has opened the lid on myriads of social problems. One consequence of a global scale of 'social distancing' is that organisations will suspend routine jobs which lead to corporate and economic recessions. Recessions also result in job cuts and losses that lead to frustration, bitterness, poverty, and famine. Another consequence is that when business owners and commercial entities stay away from their centres, street urchins take laws into their hands with the banditry and looting of stores, for example. Enforcing lockdowns without governmental provisions of adequate palliatives during the lockdowns breeds hunger and other measures of armed banditry.

1.6 The Future of PCMS System

The methodology of implementation for future PCMS systems must be rigidly built around a proactive mindset and strategies. Scalable, flexible, and cost-adaptive options offered by current cloud-based solutions must also be often examined and overhauled for improvements. A reliable PCMS system must be anticipatory and well equipped for needed actions.

The methodology of implementation for future PCMS systems must be rigidly built around a proactive mindset and strategies. Scalable, flexible, and cost-adaptive options offered by current cloud-based solutions must also be often examined and overhauled for improvements. A reliable PCMS system must be anticipatory and well equipped for needed actions. Future PCMS systems must target addressing all the problems currently posed by the COVID-19 outbreak as well as simulate other possible scenarios and counter-measures.

Given the numerous advantages of using services, applications, and resources hosted in the cloud, there is no doubt that cloud architecture will be ideal for achieving the goals of a PCMS system. Viral cases such as the current pandemic (code-named COVID-19) closely mimic nuclear chain reaction patterns of spreading so fast before mitigatory measures can be thought out. This informs the decision for a computerised pandemic control and management support system project over two years for designing, researching, and creating a surveillance system as aids equipping either the government or the citizens with comprehensive pandemic data. This paper x-rays current and future PCMS systems, their issues as well as their problems and proffered solutions.

In this section, attention has been focused on the purpose of such a PCMS system to include an emergency response initiative which will effectively and ultimately equip health care experts as well as governmental agencies with all necessary information for proactive measures. Also, several ethical issues have been thrown up by pandemic influenza (such as the current COVID-19 case). Topics such as a diverse honest approach to pandemic planning, the implications of pandemic influenza for human rights, how to guarantee unhindered access to health care during pandemics like this, the obligations of and to health-care workers, etc. The benefits of such a successful PCMS system shall include the empowerment of the health care providers and public health authorities to modify their strategies for case management, community mitigation, and health resource allocation which

Also, in considering how a cloud-based approach will significantly enhance the methodology of such a solution, the Google Cloud Platform (with Google as the OEM) was evaluated for its distinguishing innovative technologies. Lastly, recommendations examined include those revolving around planning and coordination of the PCMS, the situation monitoring and assessment, efforts for reducing the spread of the disease, continuity of health-care providers, and effective communication of real-time events.

2.1 Scope for Project

2.1.1 Project Summary and Justification

The request for this project is to assist in a government based Effort to mitigate the effects of a plague at the early stage through the need for a computerised PCMS system. PCMS system being considered will be a two-year project to design, research, and produce a support system for aiding either the government or the citizens with comprehensive pandemic data. Data shall include the pandemic origin and biological family, the demographic distribution of those infected, etc. They shall also have warning signs, advice, and necessary care arrangement for the citizens, available statistics, prediction analytics for simulation and pandemic outbreaks as well as social media integration and news feeds. The system will also allow for online and offline cloud interaction that will contain the architecture to support data logging, event viewing, statistics, probability generation The cloud infrastructure should utilise google's existing cloud architecture to allow for seamless integration into an existing platform, this will also allow for easier integration into existing systems. Multi-system support through desktop, web and mobile. This system will allow for future early stage pandemic prevention and awareness to reduce the global impact of a viral outbreak through the widely accessible statistics available in modern globalisation.

2.1.2 Project Charter:

Key Schedule Milestones: 1. Project requirements document, 2. System UIX design, 3. System Prototype, 4. Installation and Integration complete, 5. Monitoring and Controlling the audit system, 6. Closing evaluation

Budget Information: The current estimated budget pertains around $200000

Project Objectives: Develop a multi-platformed cloud-based pandemic control and management support system for the government to implement to get comprehensive information on viral pandemics and diseases. This objective is aimed to be completed within two years, and meet all standards of software development and design methodologies.

2.1.3 Project Characteristics and Requirements:

1. *Articles:* The dashboard section will allow for content appropriate articles to be viewable, giving information related to ongoing global pandemic news. They will also be downloadable in PDF format.
2. *Links:* All free links for content will be assessed weekly for appropriate usefulness and relevance.
3. Security: All internal employees will have access to the entire system for auditing purposes. The comprehensive audit trail system will be active for authorisation purposes. Weekly database auditing protocols. All user password and two-factor authentication necessary.
4. *Search Feature:* A search feature should be present to locate content by topics and keywords.
5. *Dashboard*: An overall home screen that will contain summary information for all aspects of the application.
6. *24-hour availability:* The system should be available 24/7 7 days a week from any internet-connected location, with support for offline capabilities.
7. *Social media integration:* The system should incorporate mainstream media embedding into the systems GUI to show news and other viral related content easily.
8. *Push alerts:* The system should allow users to receive push notifications of pandemic news, cases and areas affected close to the user. This should be accessible from desktop, mobile and web versions of the application.

9. *Flexible information system integration:* Through the use of Google cloud services hosting and the use of open-ended relational database management system, the system should be able to be implemented into existing information systems easily.

2.1.4 Product related Deliverables:

1. *Instructions:* the system will provide users with help, user documentation and assistance tools implemented into the dashboard to assist the users.
2. Application Modular Design: The physical UI Should be able to accommodate alternating screen designs and aspect ratios to ensure all content is delivered no matter the platform it is operating on.
3. *Database management system:* The back end DBMS system should accommodate all creation, deletion of modification is internal data within the application. The DBMS should be scalable for future expansions and integration into other systems and support adequate auditing and query application.
4. *Test Plan:* A fully outlined test plan will document how the pandemic control and management system will be tested, the nature of the tests, the outcomes and overall reportings.
5. *Predictive analytics algorithms:* Several Predictive analytical algorithms modules will be implemented, such as Monte Carlo simulation and multiple regression to predict the severity, deaths, infection rates and more related to current and future pandemic outbreaks.
6. *Global viral mapping:* The dashboard should support a live global viral mapping function utilising a global map with hotspots and top country tier list by infection count. The viral mapping will be updated through various statistical source.s
7. *Event viewer:* There should be an event viewer for internal employees to access that will show all critical events within the PDCMS. Including backups, errors, warnings etc.
8. *Automated Data source integration system: T*he system should contain a significant subsystem that will scrape all relevant metadata from essential sources such as hospitals, shelters, DMATS and health organisations into a singular data table form. This will then be distributed throughout the application. This process should occur regularly within the back end of the system.

2.1.5 Project Success Criteria:

The goal is to complete the project within two years and not above the allocated budget of $200,000. There is the emphasis to follow a semi strict software development life cycle, but also allow room for changing and flexible delivery requirements (Lech 2013). For the final product to be successful from a technical standpoint, it must be accessible and have all system functionality from all device types, and implement all listed statistical methods and predictive capabilities. Furthermore, the system must be accessible from both online and offline sources and incorporate a robust security system that receives constant updates. If the system finishes slightly above budget or over time, but still fulfils all requirements at a high level, it will always be considered a success.

2.1.6 Controlling Scope:

Scope control allows the changing and addition of critical tasks without increasing unnecessary items or functions that would be suited for a later version that if added could cause a project to fail to meet its deadlines (PMK 2020). For this project, the key stakeholders will be encouraged to solicit changes that will benefit the overall project instead of suggesting unnecessary changes. Variance analysis will be used to map out the planned and actual performance of the project's development. Furthermore, to manage scope creep, several controls will be implemented. There will be several user meetings with defined agendas, occurring regularly. Ensuring the project schedule allows enough time to produce the deliverables and the teams will utilise use case modelling and collaborative application design to bring together project stakeholders. All requirements will be done in writing to ensure they are kept current and readily available throughout the development process. Key completion dates will be emphasised throughout the process, and the ability to review requirements changes will be general.

2.2 Work Breakdown Structure (WBS) and Deadline:

- **Project Initiation**
  - Scope Requirements
  - Cost Constraints
  - Review Processes
  - Feasibility Study
  - Develop Business Case
  - Identify Roles
- **Analysis & Requirements**
  - Software Requirements Specifications Document
  - Delivery Schedule
  - Preliminary Software Requirements
  - Needs Analysis
- **System Design**
  - Finalise UX Design
  - Design UX Submenus
  - Design UX Dashboard Mockup
  - Develop Back end functionality prototype
  - Develop functional cloud specifications
  - Review preliminary software Specifications

- **System Development**
  - System Development Review
  - System prototype
  - Developer Testing
  - **Develop Code**
    - API Integration
    - Online infrastructure
    - UX Integration
    - Cloud architecture
    - DBMS
    - Back End Infrastructure
  - Assign development staff
  - identify modular/tiered design paramteres
  - Review functional specifications
- **Implementation**
  - Deployment Complete
  - Obtain user Feedback
  - Install/deploy software pilot
  - Train Support Staff
  - Secure deployment resources
  - Develop deployment methodology
- **Monitoring & Controlling**
  - Closing Evaluation
  - Create Software Maintenance team

	Start	Finish
t Initiation	16/05/20	15/07/20
sis & rements	20/07/20	23/10/20
n Design	26/10/20	22/3/21
n pment	29/3/21	20/9/21
mentation	6/10/20	13/02/22
oring & olling	16/02/22	20/05/22

2.3 Scope: Budget & Costs

Each phase in the development of the deliverables is expected to ascertain its own allocated budget. To correctly outline the budgeting and costs a process has to be undertaken. The initial cost management has to be planned, the estimated expenses, a budget determined, and finally, the prices are to be controlled.

The overall estimated costs for the project equal to just under the allocated amount of $200,00. Each cost estimate can be broken up into the main phases of development and their subsequent deliverables.

Phases:

Project Initiation: This initial phase of development is estimated to cost $15,000. Due to the lack of tangible resources, it will require, the main bulk of the costs would contain staff allocation and hours.

Analysis & Requirements: This second phase of development is estimated to cost $24,000. The main costs will revolve around the srs documentation workload and software licensing required to create a delivery schedule.

System Design: The system design will have to entail the costs of designing the mockups, the functional prototype, all UI and UIX designs and the cloud specifications. With all software, resources and staff considered this is estimated to cost $50,000

System Development: The system development will be the most expensive phase due to its length of time and resources required to complete. These include vital milestones such as the prototype with the back end infrastructure, UX integration and cloud architecture. This phase is expected to cost ~$70,000

Implementation: The implementation phase will require the training, installation and deployment of the system into the existing architecture. The majority of the costs will come from the extensive user training and system integration, totalling $20,000

Monitoring & Controlling: This last phase costs will incur around the creation of the maintenance team and subsequent systems and protocols to establish a long term maintenance process. This is estimated to cost $15,000.

Deliverables:

Database management system: Due to the size of the organisation this system will potentially be utilised in the overall rollout of the DBMS will be around $7,000, and this aligns with the industry average for the size of the organisation at hand (costowl, 2020)

Predictive analytics algorithms: The implementation of several simulations and predictive based algorithms will have to utilise licensed libraries to implement and will cost $4,000

Automated Data source integration system: The Data source system will be capable of scraping through legitimate sources through an API and integrating them into the system. This system would cost $10,000.

Global viral mapping: The Global Viral mapping would require specialisation in GUI and animation based analytics visualisation. This feature would require $5,000.

2.4 Expected Benefits

Description	**Type**	**Success Criteria**
The rapid accumulation of critical clinical, epidemiological and virological data about the new disease.	Intangible	Correct source implementation.
The enablement of health care providers and public health authorities to modify their strategies for case management.	Intangible	Query management and strategy guides.
community mitigation, and health resource allocation.	Tangible	Successful implementation of push alerts and infection zones.
Smoothly and efficiently dispersing the workload among the first affected countries.	Intangible	Real time global updated infection statistics available.
Equipping the WHO to serve as a stabilising and credible resource for pandemic control.	Intangible	Integration into information systems easily.
Access to pandemic related statistics and real time updates quickly and efficiently	Tangible	Accessibility to several sources.
Accessibility to application multiple platforms	Intangible	Installation available from multiple source points.
Real time updates of medical supply and stock	Tangible	Successful Integration into medical information systems.

2.5 Benefits Realisation Plan

Desired Benefit	**Stakeholders Impacted**	**Enablers required to realise benefit**	**Outcomes displayed**	**Baseline Measure**	**Who is Responsible?**	**Target Date**
Accumulation of Disease Data	WHO, Dept of Health, Users	Software Team, Senior Management, HR, Aus Government	Accessible and accurate digital disease date	Data count of accessible data, access speeds	Software project team, Board of directors, Dept of Health.	15/8/21
Ability to modify strategies for case management	Public & Private Health care Employees, patients	Public & Private Health care Institutions, Dept of Health, Aust government	Comprehensive reporting.	Amount of alternative plan options predicted.	Software project team, Board of directors, Dept of Health.	15/8/21
community mitigation,and resource allocation.	WHO, Dept of Health, Users	Local governments, Dept of Health, Hospitals.	Live updates of Resource allocation and community counts	Resource allocation average trends.	Software project team, Board of directors, Dept of Health.	15/8/21

Adequate workload disbursement among first countries	WHO, Dept of Health, Users	WHO, Software Team,	Global viral mapping, showing cases and outbreak severity.	List of countries available.	Software project team, Board of directors, WHO	15/8/21
Equip WHO as a credible resource	WHO	Software Team, Senior Management, HR, WHO	WHOs online reputation increased, Quarterly reporting	WHO trust and reliability average polling.	WHO, Public & Private health care institutions.	14/9/21
Real time Pandemic Statistics	Users, Who, Dept of Health	Software Team, Senior Management, HR, Aus Government	Predictive modelling, visual graphs, simulations	Amount of algorithms run per day. Predictive success rate	Software project team, Board of directors, WHO	17/9/21
Multi-platform accessibility	Users, Who, Dept of Health	Software Team, Senior Management, HR, Aus Government	Application use across Android, IOS etc	Full functionality across all platforms	Software project team	18/9/21
Medical supply and stock updates	Dept of Health,Public & Private Health care Employees.	Public & Private Health care institutions, Software Team	Full inventory stocklist	Keep above minimum inventory stock.	Software project team, Public & Private Health care institution	13/9/21

3.1 Stakeholder Management

On account of the project's potentially vast global influence, the identification and management of stakeholders will be paramount to its successful delivery. Stakeholders in this context shall refer to both internal and external entities affected by the project in some way. The management of stakeholders shall be carried out in a four-phase process.

Identifying Stakeholders: It is vital to identify all potential stakeholders and effectively categorise them to allow for the development of optimal engagement strategies. In order to do this, a stakeholder register must be constructed, in which stakeholder's identification, assessment and classification information shall be stored.

Stakeholder Register			
Name	**Classification**	**Role**	**Engagement Level**
Executive Management	Internal	Overseeing the project	Leading
Development Staff	Internal	Executing the project	Leading
Analytical Staff	Internal	Project analytics	Leading
Shareholders	Internal	Funding the project	Leading
Australian Department of Health	Internal	Primary sponsor	Leading
World Health Organisation	External	Beneficiary	Supportive
Healthcare Workers	External	Beneficiary	Supportive
General Population	External	Beneficiary	Unaware

Stakeholder authority is to be determined via the attribution of Power-Interest grids to each stakeholder to gauge the ratio of their influence over the project against their concern in its outcome. This authority rating shall be then used to determine the appropriate level of engagement.

Source: Project Management, Project Management Institute. Stakeholder Analysis using the Power Interest Grid. Updates March 24, 2017.

Planning Stakeholder Management: Once stakeholders are identified and categorised, a plan must be devised to determine optimal engagement strategies with each stakeholder. This will take the form of a Stakeholder Management plan which will entail the current and desired levels of engagement with each stakeholder, their interrelationships with one another, and communications requirements and individual management strategies. Also included shall be a methodology of updating stakeholder management plans and any contingency plans in the case of unforeseen circumstances. Initial information shall be gathered in the stakeholder kick-off meetings, and continually amended by ongoing discussions. Sensitive stakeholder information is to be omitted from this document as it is an official document viewable by all stakeholders.

Executing Stakeholder Management: Continuous communication with stakeholders shall be ongoing throughout the entire project to maintain expectations and keep stakeholders informed on the project's performance, explain any consequences and avoid any surprises. This continuing dialogue will allow for quick implementation and updating of any contingency plans. The Australian Department of Health, our most valuable external stakeholder, will be receiving monthly performance updates and will be requested to respond with monthly reviews, including issue logs, change requests and plan updates. Other stakeholders such as the WHO and any concerned healthcare workers & organisations shall be managed via social media platforms where they can directly contact support staff with suggestions and complaints. Internal staff needs are to be managed via the Atlassian suite, including Trello for project management, Confluence for document management, Jira for issue control and Bitbucket for software version control. Atlassian has been selected on account of its unification of several desired products under the one package.

Monitoring and Controlling Stakeholder Engagement: Stakeholder engagement shall be closely monitored through the frequent communication of performance information, change requests, document updates and organizational updates. This will enable levels of attention to be precisely controlled on a per stakeholder basis. Key stakeholders will be given a podium to express concerns and propose solutions, while less engaged stakeholders will be allowed to convey their impressions via surveys and reviews. All issues are to be logged and reiterated in internal staff meetings. Meetings will include regular demonstrations, and all deliverables will require sign-off from critical stakeholders such as the Australian Department of Health.

3.2 Communications Management

Competent communications management will be critical to the success of the project; both internal staff and external stakeholders will need communications at various levels of engagement. Managing this communication will be executed as a three-phase process.

The management of communications will be vital to the success of the project. This entails a three-phase process in which the methods, standards and purpose of communication are established, executed and continuously monitored for quality control purposes. The complexity and size of the project call for extensive communication management, as the number of communication channels, will be immense, and both internal staff and external stakeholders will need communications at various levels of engagement.

Planning Communications Management: Stakeholder communication needs are to be determined via a communications plan. The goal of the communications plan is to identify the communication needs of the project and its stakeholders. It will outline the stakeholder's communication requirements regarding what information is to be conveyed, to whom it shall be delivered, preferred methods of communication, frequency of contact, escalation procedures for resolving issues and revision procedures for updating the communications management plan.

Key stakeholder's communications requirements are to be established initially via kick-off meetings in which key stakeholders are encouraged to engage in interactive dialogue regarding their personal communications needs. Critical information is to be distributed amongst all stakeholders via push communication in the form of regular reports over email. It will be sent frequent pull requests such as performance surveys. Internal staff communications shall be managed via the Atlassian suite, messages will be distributed through Trello, and team communications are to be held HipChat as well as through regular meetings. Stakeholders with low Power-Interest scores, such as the general public and healthcare industry's communications will be delegated to a support team who shall be contactable via initiative standard social media platforms such as Facebook and LinkedIn. All of this information is to be collected and presented in the form of a Stakeholder Analysis table.

Stakeholder Communication Analysis			
Stakeholders	**Document**	**Format**	**Due**
World Health Organisation, Australian Department of Health, Executive Management, Key Shareholders	Monthly progress meeting	Meeting, email and hard copy	First of month
Executive Management, Development Staff	Weekly progress meetings	Meeting and hard copy	Mondays
World Health Organisation, Australian Department of Health, Executive Management, Key Shareholders, Development Staff	Quarterly progress report	Email, hard copy and confluence document	Quarterly
Australian Department of Health	Performance Satisfaction Survey	Website	Monthly
Non influential stakeholders	Support Team Dialogue	Social media, email, website	Ongoing
Executive Management, Analytical Staff	Quarterly Audit	Confluence document	Quarterly

Managing Communications: The communication management process will be ongoing and will involve extensive use of technologies in order to effectively deliver project information to the correct recipients on time as described in the communications plan. This will primarily take the form of the continuous creation and distribution of deliverables such as status reports, progress reports and forecasts to those concerned. Templates for all deliverables will be provided to ensure consistent and impactful information is always provided, minimising miscommunication and confusion.

Controlling and Monitoring Communications: Stakeholder communication is to be continuously monitored for quality control in order to ensure it is meeting stakeholder requirements to an adequate level of performance. Pull communication such as performance information, change requests and updates are to be frequently requested from each stakeholder, this in conjunction with the conduction of regular meetings will ensure that communications remain dynamic and the flow of information is optimised.

3.3 Management Processes

The management process is a series of five sections process groups described by the PMBOK, which if followed correctly, shall ensure the project is carried out with optimal effectiveness and efficiency.

Initiating: The initial phase of the project is that of initiation, pre-initiation steps include the construction of documentation about the scope, addresses time and cost constraints, identifies sponsors and staff, develops a business case and reviews the project management process, establishing any expectations. This entailed the acquisition of a contract with the Australian Department of health and establishing communications with concerned stakeholders such as the World Health Organisation. They were followed by the negotiation and development of the documentation as mentioned above, the selection and approval of goal selection and sign-offs on project initiation.

Planning: The planning phase begins with the creation of documentation pertaining to the allocation of resources, time and strategies to be employed throughout the project. This is detailed within the scope statement seen earlier in this document, in which the project's feasibility is assessed, requirements are collected, deliverables are defined, control methods are devised, and a work breakdown structure is created. Requirements collection is to be conducted through kick-off meetings with the primary sponsor, the Australian Health Department, as well as with several other key stakeholders such as the World Health Organisation. This is a dialogue between stakeholders and management executives to determine the project budget, functional and performance requirements of the product, deliverable timeframes as well as communication and quality control requirements.

Dialogue regarding cost management has concluded that a budget of $200,000 is appropriate and within reason for the project. More detailed explanations of cost estimates broken down into phases can be found previously in the document. To manage to budget and establish cost control, a cost management plan will be created which details strategies on the planning and execution of resource management. This plan will be regularly revised in monthly stakeholder meetings, as well as economically analysed by our internal business analytics staff and addressed in monthly internal staff meetings and reports. Analytics is to be performed by conducting earned value management analysis, considering planned value, actual cost and earned value to gauge cost efficiency. Budgeting shall be based upon estimates determined within the scoping document based on information gathered in the requirements collection portion of the planning phase.

Quality management will be an ongoing process that is to be detailed in a quality management plan document. This document will address the methods of continuous quality control such as frequent dialogue regarding performance and expectations from stakeholders, as well as quarterly quality audits, in which the analytics team will analyse the cost-benefit, cost of quality, performance, decision making of the project to develop quality metrics for use in the quality management plan and in updating the project management plan accordingly. This dual approach of incorporating stakeholder feedback and conducting internal analysis should enable the delivery of a high-quality product.

Executing: Managing the execution phase of the project is the ongoing task of ensuring deliverables and milestones are being met. This progress will be tracked in the many meetings and reports, both internal and external. Such as the following for the first six months of the project:

Milestone Report			
Milestone	**Date of Completion**	**Status**	**Notes**
Kick-off meetings	22/05/20	Complete	Stakeholders identified
Requirements and scope	01/08/20	In progress	
Cost management plan	10/08/20	Upcoming	
Quality management plan	15/09/20	Upcoming	
Communications plan	19/10/20	Upcoming	
Stakeholder management plan	23/10/20	Upcoming	
Prototype	20/11/20	Upcoming	
Testing	25/11/20	Upcoming	

The product will be released iteratively, with frequent demonstrations in stakeholder meetings. Extensive testing will be conducted both by development staff and select testing groups; feedback will be incorporated into each iteration.

Monitoring and Controlling: The monitoring and controlling process involves measuring actual progress towards project objectives against planned progress, checking for deviation and taking corrective action if necessary. Monitoring is conducted in the form of performance reports and change requests from key stakeholders and is used to update and verify plan documents. Quarterly audits conducted by the analytical staff include official inspections to the project's risk and quality, further aiding in the controlling decision-making process. Should any aspect of the project stray from course, it shall be addressed in monthly stakeholder meetings where updated plan documents can discuss corrective procedures of action.

Closing: Closing is the final process in the series of project management process groups which involves the settlement of any outstanding issues and the acceptance and approval from key stakeholders and internal executive managers. This phase will take the form of several closing stakeholder meetings focussed on product demonstration and presentations, delivery of the product and approval sign-offs. The project shall not be considered complete without official sign-off from representatives of the Australian Health Department.

A final report and lessons learned information would be constructed, assessing the project's performance as a whole and addressing any issues from which the company's effectiveness can be evaluated, and any mistakes can be learned from.

4.1 Risk Management Plan

The First Stage of the risk management plan is to plan the risk management approach and subsequent procedures so that preparing what the worst scenarios of hazards that can occur and coordinate with the team members so that they can learn how to prevent it and not panic risks arise. Furthermore, they also need to take care of envisaging the leadership and coordination of events necessary across Departments (Lee VJ, Lye DC, Wilder-Smith A 2009). Secondly, the risks will be identified, and responses discussed. The inhouse system team will utilise several elicitation techniques to form a fair chance before, during and after the systems development. Brainstorming among the development team, Delphi technique among the senior level staff to discuss development predictions and Interviewing of crucial stakeholders.

The first significant risk for this development is the inability to integrate within existing IS systems; it is a moderate risk with a low chance of occurring. The system should have the ability to integrate within existing departmental systems and integrate within their databases. However, there is a risk that will be unable to occur or require a lengthy or expensive phased system integration. To overcome this, the back end developers of the software will have to perform extensive white hack test data within the components of the system into other systems and perform adequate research on both software and hardware compatibility states. Furthermore, the business analyst will be required to infer and communicate with other providers of information systems for potential future integration.

Thirdly, the threat of a system-wide security flaw or malicious user getting inside the system will be hazardous, the stealing of employee and user information like their home address, name, email and all of the people's personal information (Valter L, Nyce JM 2009). The data can be used for malicious or commercial purposes. The chance of this occurring is low, with a high repercussion. To combat this risk, an extensive Cybersecurity Team will need to be established, due to the global nature of the application, (Valter L, Nyce JM 2009). The team will develop and provide a suitable security flaw prevention system and create countermeasures to stop breaches such as firewalls, audit logging and password two-factor authentication.

Fourth, The risk of not having adequate cloud backup controls and system stability checks. The purpose of having stability testing is to allow the system to function over a long period, within its full capacity and not failing or causing failure to other surrounding systems or stakeholders (Guru99 2020). The PCDMS needs to ensure system stability adheres through preventive and detective maintenance measures enacted upon on a strictly scheduled basis performed by authorised auditing and maintenance teams. The risk is procedures are not followed could cause system failure, shutdowns, inaccurate reporting, malicious attacks or failure of updates. The level of risk if High with a low chance of occurring.

Lastly, the risk of not meeting or adhering to systems budgeting and deadlines. During iterative system development methodologies the scope and WBS structure outline the budget estimations, as such in this case, it amounts to $200,000 and a two-year project development plan. Critical tasks require little slip within their structure, and due to the iterative nature of the development, significant milestones are entirely dependent on previous steps being completed, such as the case for creating a prototype. If the schedule does not adhere to the projects estimated delivery time will be extended, and overall project flow disrupted, as the most time-consuming aspect of software development is the transitional time between phases (Ediz 2012). Furthermore, the estimated budget for each deliverable must be adhered to and subsequently reviewed frequently. Cost estimations performed through NPV and earned value management to ensure the correct funding allocation is occurring, as the risk of funds being over-allocated to sections can occur. This may mean further deliverables along the development path will be unable to receive adequate funding. The trouble is Moderate and Consequence very high.

4.2 Risk analysis

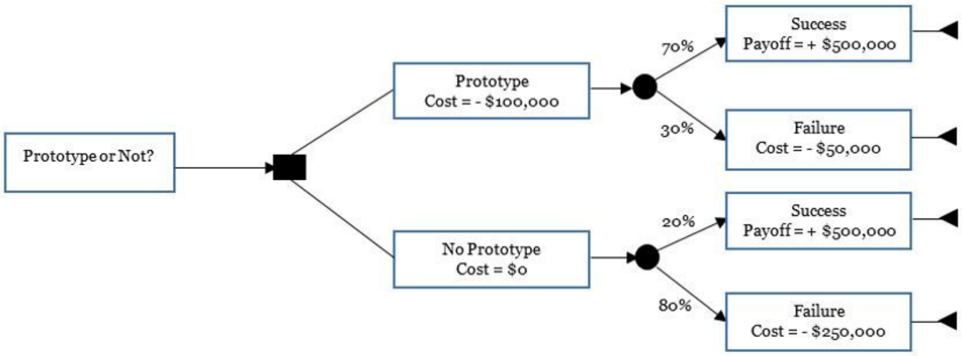
A risk breakdown structure will be used to form good recommendations, and it is used as a hierarchy of potential risk that can happen. It also used to identify and categorise risks.. (WHO 2009). The main two recommendations for chance are to perform adequate qualitative and quantitative risk analysis utilising specific tools and methodologies to adequately assess and control the risks mentioned in the plan throughout and after the development of the system.

4.2.1 Quantitative Risk Analysis

The simulation uses a model of a system to analyse the expected behaviour or performance of the system. (WHO 2009). Simulation Techniques can be utilised within the systems operations to estimate the efficiency of high workloads, system operation times and potential flaws in the system under live situations. The system can run simulations of live pandemic outbreaks with large amounts of data to test the system's ability to handle potential system instability and backup failures.

Sensitivity analysis is a technique to show the effects of changing one or more variables on an outcome (WHO, 2009). It can be utilised within this development to see how differing variables of cost and budgeting change the overall result, influencing profit, losses, expenses and determining break-even points based on different assumptions (WHO 2009).

Furthermore, utilising Decision trees and Estimated monetary value (EMV) Analysis is recommended. EMV calculates the average outcome when the future has uncertain scenarios in place. It will give a probability of a financial outcome given the choices and can be used to analyse potential financial risk.



Source: MPUG 2017, PMP Prep: Decision Tree Analysis in Risk Management, updated february 20th 2017

Qualitative Risk analysis 4.2.2

Qualitative risk analysis techniques shall be employed in order to determine the priority of risks in accordance with their probability of occurrence, minimizing uncertainty in the project.

The recommended method of qualitative risk analysis is a Probability-Impact Matrix:

		Probability			
		1 = high (80% ≤ x ≤ 100%)	2 = medium high (60% ≤ x < 80%)	3 = medium low (30% ≤ x < 60%)	4 = low (0% < x < 30%)
Impact	A=high (Rating 100)	(Exposure – Very High) (Score 100)	(Exposure – Very High) (Score 80)	(Exposure – High) (Score 60)	(Exposure – Moderate) (Score 30)
	B=medium (Rating 50)	(Exposure – High) (Score 50)	(Exposure – Moderate) (Score 40)	(Exposure – Moderate) (Score 30)	(Exposure – Low) (Score 15)
	C=low (Rating 10)	(Exposure – Low) (Score 10)	(Exposure – Low) (Score 8)	(Exposure – Low) (Score 6)	(Exposure – Low) (Score 3)

Source: Project Management, Project Management Institute. Risk analysis and management - a vital key to effective project management. Updated March 3, 2008.

This will be conducted by the analytics staff and will enable risks to be categorically identified and responded to with appropriate levels of mitigation corresponding to their score.

Risk Response 4.2.3

Technical Risks	Cost Risks	Schedule Risks
Emphasize team support and avoid standalone project structure	Increase Frequency of project monitoring	Follow WBS and CPM

Assess project manager authority	Utilise financial estimation tools and analysis e.g. NPV	Ensure review time after each development phase
Utilise problem handling and communication techniques such as brainstorming.	Assess Project manager authority	Weekly reports on development progress
Increase the amount of project monitoring controls, e.g. audit trail	Review financial situation quarterly	

Recommendations 4.3

Development: It is recommended the project adhere to the detailed WBS and schedule created, utilising a waterfall-based development approach. The software development team, however, should maintain consistent communication between the low, high-level developers and the project management team to ensure smooth delivery of all requirements. The development should utilise the structure to stay within budget and time constraints, and the project manager should continuously reinforce the importance of the project schedule. Consistent communication must also be made to the Australian Government and WHO as the project progresses and prototypes are developed to ensure the development is in line with their requirements.

Risks: Through the risk management plan and analysis techniques listed the project team should also ensure they are reviewing the efficiency of the risk management processes and should create test data examples to evaluate the effectiveness of risk controls, contrastingly the development team should actively seek positive risk situations from the application, and understand levels of risk acceptance within the development to save time and cost. Proper Auditing techniques should be enforced and a skilled auditing team employed and integrated into the development and maintenance of the project and long term life.

Long Term Implementation: Most importantly, software development should have an outward thinking bottom-up development approach as the system is being developed. The most critical aspect of the system is its potential integration into global-based information systems, and the system will need to be compatible with several national-based systems while still providing medical information, global mapping, statistics etc. To ensure this, it is recommended the project manager maintain consistent contact with the WHO to understand the technical implications of a worldwide rollout.

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