

## **Design of a Real-Time Epidemic Alert System for Cross Border Disease Control and Epidemic Management**

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### **ARTICLE**

The key challenge with Epidemics includes its ability to spread rapidly and impact several large communities with high fatality rates. These characteristics make it difficult and very expensive to manage epidemics once it has broken out. History is replete with several cases of epidemic outbreaks spreading from the point of origin and being transmitted to other areas resulting in the deaths of several thousands and in some cases millions of the inhabitants. The distance of the spread in the early 19th century was limited due to the limitations in travel speed and distance but this did not reduce the death rates of these diseases. The small pox disease was recorded to have killed more than 20% of the population of Athens in Greece. The great plague of London was recorded to have started in China in 1334 but spread along the trade routes wiping out entire towns. Florence in Italy lost a third of its entire 90,000 residents in the first six months with Europe losing an estimated 25 Million people. In 1633, Massachusetts which hitherto had been free from small pox

became infected as settlers from France, Great Britain and the Netherlands brought the communicable disease with them resulting in the death of several millions. Other infectious diseases which have resulted in epidemics resulting in the deaths of several thousands of people in other regions of the world include the HIV/AIDS, H1N1, flu pandemic, the Severe Acute Respiratory Syndrome among other epidemics, these epidemics are usually spread by virtue of the cross border migration of the disease hosts. The UAE is gradually becoming the global holiday resort of choice while the UAE and Qatar are becoming the major transit hubs to India and China both of which account for over one billion of the world's population. Both regions are also bounded by Saudi Arabia which plays host to the world when they come to perform the holy pilgrimages to Mecca. This makes Qatar a location with a high potential for epidemic out breaks and necessitates the development of a robust real-time health monitoring systems capable of tracking possible epidemic causing diseases before they spread to the general population. The most effective means of containing the spread of epidemics is by monitoring the populace and quarantining any suspected victims or patient with a view to treating the case in isolation and controlling/preventing the spread of the epidemic to the general population. The transmission model for epidemics is represented by the branching process which shows the patient zero is the primary source of the diseases and the rate of spread of the disease is determined among other factors by the contagion probability of the disease. The current health management system does not provide a means of automatically identifying a likely epidemic and informing the relevant agencies to ensure the disease is contained by quarantining the patient zero. This work presents the development of an integrated health management system deployed as an application running on laptops and tablets to be used by Doctors during consultation with patients for monitoring diseases occurrence in real time. It monitors patients and tracks in real time, the different diagnosis, patient location and possible epidemics by tracking the symptoms reported by the patients as they are examined in the consulting rooms and the results of the different tests and examinations ordered by the doctors. It provides a means of alerting relevant healthcare authorities and all the other hospitals as soon as a case is identified in any consulting room. It harvests key diagnosis and monitors the number of occurrence of the reported ailments, the dispersion mechanisms and the possibility of the disease resulting in an epidemic. This data is transmitted and collated at a central health management unit. Different thresholds are set for the different ailments and dispersion mechanisms and when the thresholds are exceeded, the appropriate response mechanisms are deployed to the affected areas. When any of the known epidemics are detected in any consulting room, a high alert is sent to all the doctors in that hospital and containment systems deployed immediately to the affected hospitals for quarantining the patient and taking the necessary steps to ensure that the disease doesn't spread to the community. In the event of an epidemic, the application will generate the required emails to the relevant government agencies and send an SMS to the responsible parties to ensure appropriate action is taken. Relevant agencies in different countries can deploy this system and share information between their airports, immigration agencies, health management agencies etc, whenever any of such epidemic causing diseases break out or is reported in any of their hospitals. This will enable the different governments set up and deploy the relevant response teams and tools to ensure that the disease does not cross into their country and in the event that it arrives at the airport, the patient is immediately quarantined and investigated and the necessary medical treatment administered.

## Publication Information