International Journal of Modern Agriculture, Volume 9, No.4, 2020
ISSN: 2305-7246

INTEGRATED ARTIFICIAL INTELLIGENCE REMOTE SMART PANDEMIC ASSESSMENT CABIN (i-RSPAC) AS ALTERNATIVE SOLUTION OF PREVENTION AND CONTROLLED THE PANDEMIC

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2020

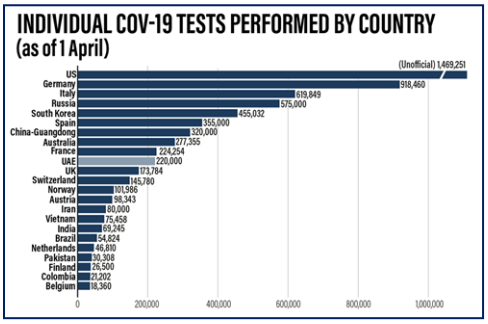
Abstract

As present dynamic global challenges raised and focused in how to monitor, control and prevent the escalation of pandemic; most of the countries have similar challenges to provide accessible healthcare services, pandemic monitoring and citizen health assessment to identified, monitored, and controlled the escalation of pandemic. Each country in global race era to get maximum rates of citizen population health testing as reference and identified the escalation of pandemic and get feedback information related the control measures effect, which has been taken.

This research paper is part of analysis review the relationship of population testing rate with 5(five) main features to identify, mitigate and control the pandemic through provision of independent automated remote medical assessment cabin.

In today cutting-edge global technology, Artificial Intelligence has reached significant growth and support Smart City Pillars Development including Environment, Living, Mobility, Governance, Economy, and Peoples. Integration of the technology have made significant additional value to better advanced function in development of Smart City, Smart Village, Smart Country or even Smart Global Integrated System. Several modern countries have started massive and integrated development in integrated Artificial Intelligence as part of Embedded Smart City Integrating System. The positive impact to this growth is borderless and cashless society has been growth significantly, which affect to the changes of living style, mobility, economy, people interaction, government services, and environment.

As present dynamic global challenges raised and focused in how to monitor, control and prevent the escalation of pandemic, most of the countries, have similar challenge to provide accessible healthcare services, pandemic monitoring and citizen health assessment to identified, monitored, and controlled the escalation of pandemic including accessible information. Each country in global race era to get maximum rates of citizen population health testing as reference and identified the escalation of pandemic and get feedback information related the control measures effect, which has been taken.



Graph 1. Individual Cov-19 Tests performed by Country (The National, April 2020)

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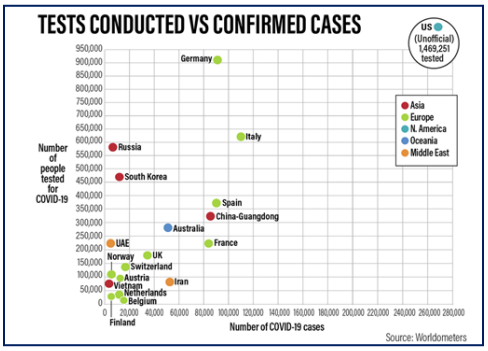

Graph 2. Test Conducted vs Confirmed Cases (The National, April 2020)

The Exploratory Data Analysis methodology defined as below :

a. Data mining/ gathers from Wordlometer,
b. Correlation Data Analysis
c. Predictive Power Score Analysis
d. Linear Regression Analysis
e. Decision Tree Analysis

As Pandemic World Report which has been gathered from Wordlometer on 18 December 2020, with focused to 49 Asian Country, with total population test as target, and features data (total case, total death, total recovered, new case, active case),its observed that 14% or 7 countries have met population testing rate above 50%.

```
[9]: AsiaCountryData.count()

[9]: No.                  49
     Country,             49
     Total Cases          49
     New Case             49
     Total Death          49
     New Death            49
     Total Recovered      49
     Active Cases         49
     Serious, Critical    49
     Tot Cases/ 1M Pop    49
     Deaths/ 1M Pop       49
     Total Tests          49
     Tests/ 1M Pop        49
      Population          49
     Test Rate            49
     dtype: int64
```

Table 1. List Data Count

From 49 Asian countries have mean/ average total tests 9,408,651 compared to the average total case 397,817.

```
round(Features1.describe()),1

(       Total Tests  Total Cases  New Case  Total Death  New Death
 count         49.0         49.0      49.0         49.0       49.0
 mean     9408651.0     397817.0      22.0       6493.0        0.0
 std     31460635.0    1436694.0     152.0      21846.0        2.0
 min            0.0         31.0       0.0          0.0        0.0
 25%       462833.0       9759.0       0.0         85.0        0.0
 50%      1527037.0      89743.0       0.0        913.0        0.0
 75%      4656410.0     201368.0       0.0       2739.0        0.0
 max    160000000.0    9977834.0    1062.0     144829.0       11.0

        Total Recovered  Active Cases  Serious, Critical
 count             49.0          49.0               49.0
 mean          361670.0       29655.0              558.0
 std          1366160.0       61966.0             1698.0
 min               30.0           0.0                0.0
 25%             4616.0         468.0                0.0
 50%            87846.0        8874.0               12.0
 75%           169282.0       25695.0              196.0
 max          9520044.0      312961.0             8944.0  ,
 1)
```

Table 2. Descriptive Data

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Through Correlation Matrix Data Examination between Total Test with Total Cases, New Case, Total Death, New Death, Total Recovered, Active Cases, New Cases, and Serious/Critical; its found that Total Test have strong pair correlation with Total Cases, Total Death, Total Recovered, and Serious/Critical.

Correlation Total Test Vs Features Asian Country Data
as Worldometer Report 18 December 2020

	Total Tests	Total Cases	New Case	Total Death	New Death	Total Recovered	Active Cases	Serious, Critical
Total Tests	1.00	0.68	-0.02	0.66	-0.03	0.69	0.48	0.53
Total Cases	0.68	1.00	-0.04	0.96	-0.04	1.00	0.81	0.84
New Case	-0.02	-0.04	1.00	-0.04	1.00	-0.04	-0.04	-0.03
Total Death	0.66	0.96	-0.04	1.00	-0.04	0.96	0.86	0.88
New Death	-0.03	-0.04	1.00	-0.04	1.00	-0.03	-0.04	-0.03
Total Recovered	0.69	1.00	-0.04	0.96	-0.03	1.00	0.79	0.83
Active Cases	0.48	0.81	-0.04	0.86	-0.04	0.79	1.00	0.94
Serious, Critical	0.53	0.84	-0.03	0.88	-0.03	0.83	0.94	1.00

Table 3. Data Correlation

Exploratory Data Analysis through Linear Regression method with split train and test data 80, 20 ratios, the result is target and features data have strong positive relationship.

```
Linear Regression Relation Analysis
Asian Country Pandemic as 18 Dec 2020 Data
Total Population Test VS Total Cases, Active Cases, Total Death,Total Recovered,Serious/Critical
Train Test Data 80:20 with Random State= 42

Source :
        Moore, D.S, Notz,WI,& Flinger, MA (2013), The Basic practice of statistic 6th Edition,
        New York : WH Freeman and Company page 138
-----------------------------------------------------------------------------------------------

Train Data R squared : 0.985
Train Data have Strong Positive Relationship
Test Data R squared : 0.917
Test Data have Strong Positive Relationship
```

Graph 3. Linear regression validation results

Meanwhile through Predictive Power Score Analysis, it's found that total test having relation with serious/critical.

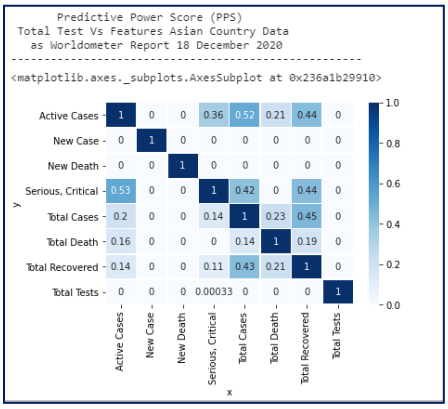


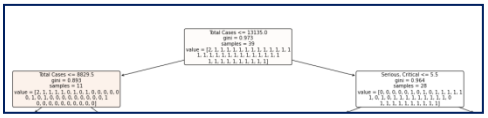
Table 4. Predictive Power Score Analysis

```
dfppspps.matrix(Features1x)
dfp.head()
```

	x	y	ppscore	case	is_valid_score	metric	baseline_score	model_score	model
0	Total Tests	Total Tests	1.000000	predict_itself	True	None	0.000000e+00	1.000000e+00	None
1	Total Tests	Serious, Critical	0.000000	regression	True	mean absolute error	5.562041e+02	9.855881e+02	DecisionTreeRegressor()
2	Serious, Critical	Total Tests	0.000332	regression	True	mean absolute error	8.873553e+06	8.870609e+06	DecisionTreeRegressor()
3	Serious, Critical	Serious, Critical	1.000000	predict_itself	True	None	0.000000e+00	1.000000e+00	None

Table 5. Predictive Power Score Analysis

With reference of PPS Analysis, the further examination by perform through decision tree analysis.



Graph 4. Decision Tree Analysis

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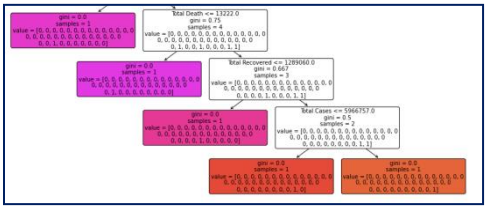
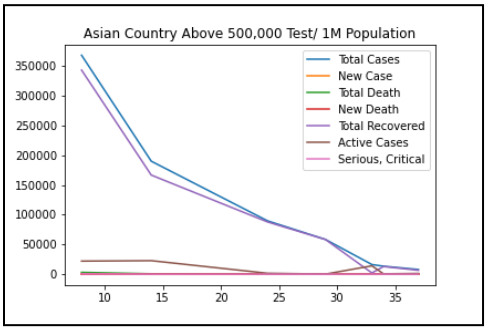
The examination through depth 22 to get gini ratio 0.



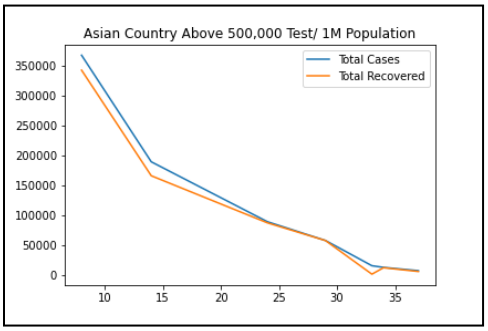
Graph 4. Decision Tree Analysis with depth 22

As observed from graphic plot distribution, it's shown that country with testing rate above 500,000 Test/1M Population, Total Case and Total Recovered is highly identified.

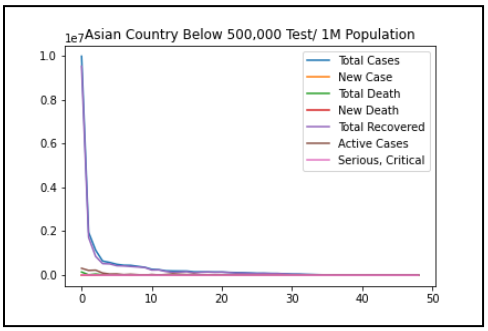


Graph 4. Country with above 500,000 Test/ 1 M Population

With visibility of main features identification, the government or decision maker could perform mitigation and control the area of pandemic through clustering or other approaching tracking method.



Graph 5. Country with above 500,000 Test/ 1 M Population



Graph 6. Country with below 500,000 Test/ 1 M Population

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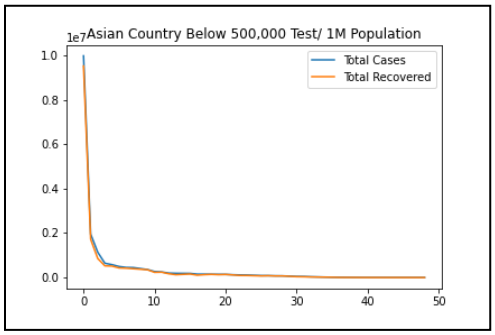


Graph 7. Country with below 500,000 Test/ 1 M Population

The main reason observation to 92% countries with below 500,000 Test/ 1M Population testing rate, mostly due to limited accessibility of pandemic testing facility to the citizen. And majority of countries involve health care personnel's to perform the testing instead utilizing integrated artificial intelligence self-assessment medical equipment under artificial supervised/unsupervised monitoring.

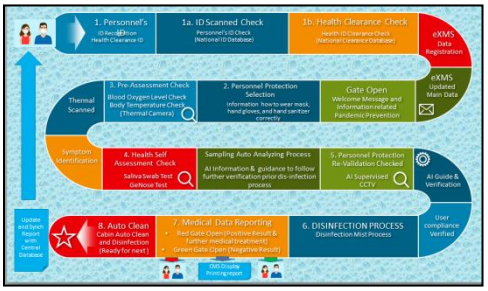
The challenges to reach the number of pandemic testing based citizen population, such as:

1. Testing method still utilizing direct involvement of medical and health care front liner to perform the test which potentially adding another exposure if improper personnel health protection is not taken in places.
2. Un-availability supervised self-assessment method with more accessible, reliable, and user friendly.
3. Less awareness from the citizen to perform health assessment.
4. Several academic research have been performed in several country to get reliable and faster analyze method with contactless/ less exposure of medical front liner, such as Gadjah Mada University in Indonesia with GeNose method.
5. Latest research of testing method have less than 5 minutes to get test results
6. Limited information could be accessed by citizen related to pandemic and how to control and mitigate it.

Main objective of this paper as alternative innovation to solve population testing rate gap due to limited medical assessment facility in several country to identified, mitigated and controlled pandemic region based on data analytic through integrated embedded Artificial Intelligence Remoted Pandemic Assessment Cabin (i-RSPAC) and provide accessible medical self-assessment and to help medical or health front liner by reducing potential exposure though minimizing direct contact.

Integrated Remoted Smart Pandemic Assessment Cabin (i-RSPAC) is technology innovation development cabin which functioned as early medical assessment/ symptom detection as part of pandemic identification, control and mitigation.

In fully integrated operation, i-RSPAC could be integrated as part of embedded Integrated Pandemic, Environment, and Disaster Country Management System (i-PEDeXMS).



Graph 8. i-RSPAC Process Operating Flow Diagram

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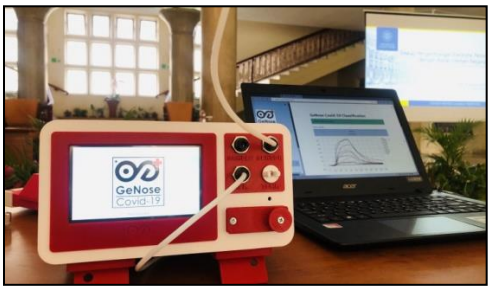
Operating Flow Diagram i-RSPAC as below:

1. Personnel ID and Health Clearance Scanned Check.
   This process performed scanning of personnel identification card such ID card, Passport, Driving License, etc. Scanned captured data image will be process through Artificial Intelligence unsupervised machine learning method and followed by identification process to Government Citizen Central Databank and update the record of Health Assessment Record. Health Clearance or Health Card Check will validate personnel's information related healthcare individual such as medical assessment history, individual allergic record, etc.
2. Personnel Protection Selection
   During this process, AI will guide the user to select the type of Personnel Protection, as minimum is hand sanitizer, mask, hand gloves, and face shield. And further AI also will guide the user to perform hand sanitizing and wear the selected personnel protection properly. During this process, AI will go through unsupervised and reinforcement machine learning methods.
3. Medical Pre-Assessment Check.
   Blood Oxygen level check will be performed to check oxygen saturation level and follow with body temperature check through thermal camera scanning. During this stage AI will guide the user, including guiding to the mark up point for thermal scanned.
   Thermal camera will capture body temperature of the user and the image will go for comparing process from pandemic symptom image database to identified whether the patient having the first symptom.
   This process will involve combination between unsupervised and reinforcement machine learning methods.
4. Semi-automated Medical Assessment/ Testing
   From this point, i-RSPAC could be set up or configured the accuracy requirement of test based on what type of method will be used. Several method could be integrated to this system as long as the testing methodology could met user friendly testing method, rapid diagnostic compatibility, portability, testing process should less than 5 minutes, support for test result digitalize data gathered process.
   As a brief process for Direct Saliva Swab Test methods, i-RSPAC will initiate to drop the sampling kit for Saliva Test through sampling dispenser. And further AI will guide the user to collect the sampling kit, take the saliva sample, and put the sampling kit in separate analyzing chamber for further analyzing process.
   For another method such as GeNose, sampling kit will drop in sampling kit dispenser and AI will guide the user to perform sampling collection through to the sampling kit and follow with sample analyzing process. The analyzing process will go for approximate less than 5 minutes.



Graph 9. Ge-Nose Assessment Method

5. Personnel Protection Re-validation
   During this stage AI will validated the correctness of wearing the personnel protection including mask, hand gloves, and face-shield. Verification process will go through CCTV

image recognition which integrated and embedded with Artificial Intelligence unsupervised and reinforcement machine learning. The guidance will be shown through visual display and audio.

6. Body dis-infection
   After personnel protection has been completely verified, the next process is body disinfection. To prevent any allergy symptom, it could be arranged to use disinfectant with combination anti allergic materials and flavor such flower. This will make add in to user as user friendly approach.
7. Record and Printing Report
   After disinfection process is completed, the system will save the analysis data, send to main server, and printing the assessment report.
   The report will contain of date, time, name, ID number, and testing report (body temperature and Test result whether positive or negative result).
8. Self Cleaning and Cabin Disinfection
   Last cycle before accepting next user, AI will perform auto clean and self disinfection.

The conclusion of development of integrated Remote Smart Pandemic Assessment Cabin including expected impact to society:

1. Reduced the direct contact of health care front liner during performing medical assessment test.
2. Provide accessibility to citizen for medical self-assessment
3. Provide self-awareness and encourage to society related pro-active control and mitigation the pandemic
4. As alternative technology solution to bridging the gap related medical self-assessment services facility especially for the country with testing population rate below 500,000 tests/ 1M Population.
5. As alternative reference base data for government or country decision maker to identified, mitigated, and control the pandemic.
6. References report or information for traveller or public places to access the public facility

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