Challenge:	Governance Hacks 2021
Team Name:	Team FLOEWS
Proposed Solution:	FLOEWS-Disaster Risk Governance
Team Composition:	Abubakar Bashir (Male), Nusaiba Adamu Misa (Female), Adam Abba Abubakar (Male), Ibrahim Abubakar Kuchili (Male).

Day 1 - 17th June, 2021 Breakthrough

- Team FLOEWS are on AfricaHacks Discord server.
- Team FLOEWS have accepted the Hackathon Code of Conduct
- Team FLOEWS have joined Dr Nevin's GovernanceHacks Hackathon Channel.
- Team FLOEWS has created a solid Team name "Team FLOEWS" on the AfricaHacks platform

- *Be sure to Join the team formation workshop if you don't have a team*
  - Team FLOEWS have joined Discord: group chat has been created & initiated, and all team members were successfully added to the channel, while roles are been defined already to each team member which includes both project/product manager, frontend/backend dev, UI/UX designer etc.
  - GitHub repo has been set for Team FLOEWS project working on Disaster Risk Governance, here is the link to the GitHub Repo:

    https://github.com/Bash-Bashmax/GovernanceHacks2021-FLOEWS-Disaster-Risk-Governance
- GitHub Repo was named GovernanceHacks2021-FLOEWS-Disaster Risk Governance with an access link: https://github.com/Bash-Bashmax/GovernanceHacks2021-FLOEWS-Disaster-Risk-Governance as instructed
  - Project Management Tool has been setup using ClickUp, here is the link: https://sharing.clickup.com/l/h/4-3476595-1/8843c15027e0f18
- Team FLOEWS product manager should will be attending the Product Management session per the schedule date.

- Define Problem team wishes solve
  - Why does my solution/project need to exist in this world?

    With about 4.6 billion people globally, 121 million Nigerians between, assets worth $Trillions living across the largest and populous urban & rural corridors of the world, all are vulnerable to different form of natural disaster. While, most of this individuals, communities, economies & governments are living within the coverage natural disaster zones are ignorant, living with less or no in-depth knowledge about impending risk nor do they have a socially inclusive access to any early warning system & guidance, overall, above all disaster risk governance is not in-place

nor taken into account by the government of the day so as to help mitigate the disaster while making such vulnerable populations be resilient to the disaster.
Natural Disaster remains a persisting hazards or catastrophe that affect Nigeria and the world in a whole with a frequency of about 85%, alone it has accounted for about 93 % of all death related to natural disaster out which 65% of the vulnerable are the under-served, the marginalized etc (GFDRR).

Natural disaster has been a major devastator with no or limited resiliency for centuries. Over the period 1995-2015, natural disaster (flood, drought, heatwave, landslide & epidemic) has accounted for 88% of all documented natural disasters, affecting 2.3 billion people, killing 9million+ and causing US$5.9 Trillion in damages and economic losses. They remain the most frequent natural disaster that affect the world with a frequency of about 71%, alone they have accounted for about 81 % of all deaths related to natural disaster.

Natural disaster affects the vulnerable population group especially the under-served and the marginalized in different ways. Social & gender inequalities increase vulnerable populations vulnerability because the current status quo and cultural norms which limits them from access to a socially inclusive natural disaster management & early warning information, guidance and resources. This makes it more difficult for them to be resilient and recover from disasters.

As the adversity of climate change kept persisting across different geographies, so as the exposure of vulnerable population, assets and biodiversity, while such adversity will continue increasing and only few or no % of those vulnerable individuals, communities or economies have a clear nor in-depth knowledge about the impending risk involved in it nor were they consulted during the disaster policy planning and decision-making process. Since climate change and its adversity can't be stopped overnight, and most of this vulnerable individuals, communities & governments lacks access early waring information nor guidance to guide them on how to better understand the impending disaster threat, monitor & forecast it occurrence, prepare themselves early and even respond to such emergency, nor even to fasten their recovery after the disaster strikes and how to be resilient against its next occurrence. Then it became very important for such disaster vulnerable individuals, communities, government and their utility & infrastructural assets to have an inclusive means of helping themselves thrive, by knowing exactly when the disaster is going to strike, its magnitude and expected devastation through a two-way citizen engagement process so as to survive the disaster while reducing losses of all type, level of exposure & vulnerability.

- Why are we building it?

  FLOEWS-Disaster Risk Governance is an all-round (end-to-end) solution that provide as a democratized and socially inclusive the way in which the authorities, public servants, media, private sector, and civil society coordinate in communities, and on regional and national levels in order to manage and reduce disaster and climate-related risks.

  FLOEWS-Disaster Risk Governance helps monitors & forecast natural disaster imminence, thereby, disseminating the forecast as an early warning intelligence as an actionable insight to the vulnerable individuals, communities & governments, why? for early preparedness, awareness, emergency response, speedy recovery & strengthening resiliency. Towards making

the actionable decision making critical enough to the reduction in devastation among lives, valuable assets & economic losses estimated in $billion, through:

- Helping public safety agencies gain a better understanding of where to focus effort to prevent, protect against, and mitigate the effect of the complex threats and hazards...
- Equipping Government agencies with data-driven insights to better respond to and recover from the threats that pose the greatest risk keeping communities safe

The proposed solution will be digitizing & disrupting impending natural disaster, thereby, dematerializing the conventional huge traditional system into small, which reduces the material size & cost, thereby, demonetizing the system to be cheap, affordable & even free, which automatically democratizes the system to open, accessible, gender-inclusive across vulnerable individuals, communities and Government (decision makers).

- Who needs our solution?
  - Governmental Ministries & Agencies: LGA, NEMA, SEMA, Ministry of Environment, Water Resources, Agriculture, Inland waterways, UBRBDA, NIHSA.
  - NGO & Humanitarian Organizations: World Bank, UN, UNOOSA, UN-SPIDER, GFDRR, UNISDR, WHO, UNOCHOA, UNDP, Direct Relief etc.
  - Enterprises/Business: Oil & Gas industry, Telco's, Insurance Insurers, Urban & Regional Planners, Real Estate & Estate Developers, logistic & Supply Chain managers, Risk & assets assessor & analyst, Engineering & construction, Surveying & Geo-Informatics, large-scale commercial farmers etc.
  - Research & Academia Education.
  - Software Developers and ICT industry.
  - Millennials & Digital Age.
  - Last Mile Users: Subsistence farmers, low class urban, rural farmstead, isolated hamlet inhabitants, the marginalized such as: women, children, disabled & aged.

2ND BREAKTHROUGH

Date: Day 2 – 18th, June, 2021

- Brainstorm solutions to problems:
  Answer:
  We've spent hours brainstorming several approach & novel sustainable methodologies to creating solutions to the problem, and our hard work has paid for we have reach a consensus on the most desirable solution we felt fit to solve the problem "Kudos". The solution is a combination of both rethinking the traditional method of solving the problem before while inventing a branding new approach to solving the problem using disruptive/exponential sets of technologies.
  We further made the solution to be both problem & user centric, in such a way that both of the will be out into appropriate consideration towards solving the problems. Value proposition were outlined, customer/user/beneficiaries were already segmented and the most corresponding channel of the accessing such values/solutions have been mapped to one another.
  Among the channels for accessing the solution are:
    - FLOEWS-Disaster Risk Governance On-Premises Deployment (On Existing IT Infrastructure).
    - FLOEWS-Disaster Risk Governance SaaS.
    - Open/Access Data Services.
    - API.
    - Web/Mobile application.
    - Social Media.
    - Email/SMS/USSD/IVR/Chatbot.
    - Print media.
    - Peer-to-Peer etc.
    - Connected via a mesh network using IoT based ducklings and mobile phone based meshed networked.
    - Cell Tower Broadcast.

  Paper based mock-ups/drawings and illustration of the entire approach was drawn and shared among team members.

- Choose a solution and outline features you want to develop (MVP)
  Answer:
  As stated above, if time permits, we will be greedily developing solution (MVP) as the following:
    - FLOEWS-Disaster Risk Governance SaaS platform.
    - FLOEWS-Disaster Risk Governance Open/Access data services for Academia & Research Institutions.

- We will develop a dedicated FLOEWS-Disaster Risk Governance API for developers and data engineers and consumers to utilize while building on top of our platform.
- We will be developing a Web/Mobile application with features capable for monitoring and forecasting impending natural disaster, disseminating early warnings and intelligence via multi-channel gateway, ensuring early preparedness and readiness among vulnerable populations, guiding their recovery process while strengthening their resiliency. The features will be a turn-key bundle featuring map-based webapp, a common operating picture, an operational dashboard, a real-time disaster reporting module (crowdsourced) etc.
- A Multi-Channel early warning dissemination channel via app notification, Email/SMS/ IVR/Chatbot etc.
- Print media/infographics inform of a risk maps and vulnerability assessment.
- Designed an IoT Mesh network using simulates and Raspberry-Pi & ESP 11/LORA wireless module to be used as a dissemination gateway vulnerable population and first responders in disaster affected areas with a damaged or less penetration mobile/internet connectivity

- Competitive analysis:

  Answer:

  Competitors: - What solutions exist that are similar?

  We don't have direct competition in Nigeria rather we have international competition such as:

  1. Deltares in the Netherlands
  2. Ambiental in the UK.
  3. Flood
  4. list in the UK etc.

  Unique Selling Points: - How is your solution different?

  1. Our Proposed solution will be dematerializing the conventional huge traditional system into small, which reduces the material size & cost, thereby, demonetizing the system to be cheap, affordable & even free, which automatically democratizes the system to open, accessible across disaster vulnerable individuals, communities and economies via the must corresponding multichannel gateway such as On premises deployment, cloud/web/mobile, web services, open/shared data, Social Media, SMS/IVR/USSD/Chatbot, Print Media, Peer-to-Peer, off-grid-Mesh Network etc.
  2. Socially Inclusive.
  3. Hyperspectral accuracy.
  4. Leverage Unique & Untapped data source from wireless signal thereby creating a Hyper-Local weather intelligence.

5. Cheap and affordable to governments and its citizens/customer segments.
6. Requires no installation, maintenance and core data
7. Can be replicable & tailored across geographies.

- Create medium fidelity prototype i.e., Whiteboard sketch, Canva https://www.canva.com , Figma https://figma.com : Note All UI mock-ups can be implemented using your favourite framework(optional) – e.g., Laravel, Django, Dotnet Core, React, Vue, Flutter, Swift, etc.
  Answer:
  Our Mock-up were implemented using React Native for cross-platform mobile apps.
  We further QML & QT & Python to for GIS-Based Apps.
  Our Geo-Big Data utilizes GBDX and ArcGIS Catalog & T-SQL for MSSQL Server 2019.
  Our Mapping Script using Python/R.
- Update project management
  Answer:
  Our Project Management Repo and Gant Chart on GitHub/ClickUp have been update already so as to keep al team members abreast, conscious of time and devised roles.
- Keep track of major issues faced/challenges
  Answer:
  - Time Constraint.
  - Working remotely.
  - Cost of internet data.
  - Primary data acquisition.
- Update and submit document with design selection process, summary of solution, competitive analysis and snapshots or link of prototype
- Team formed: WE have formed our Team already, “Team FLOEWS”.

3rd BREAKTHROUGH

Date: Day 3 – 19th, June, 2021

- Identify technologies that will be used to build

  Answer:

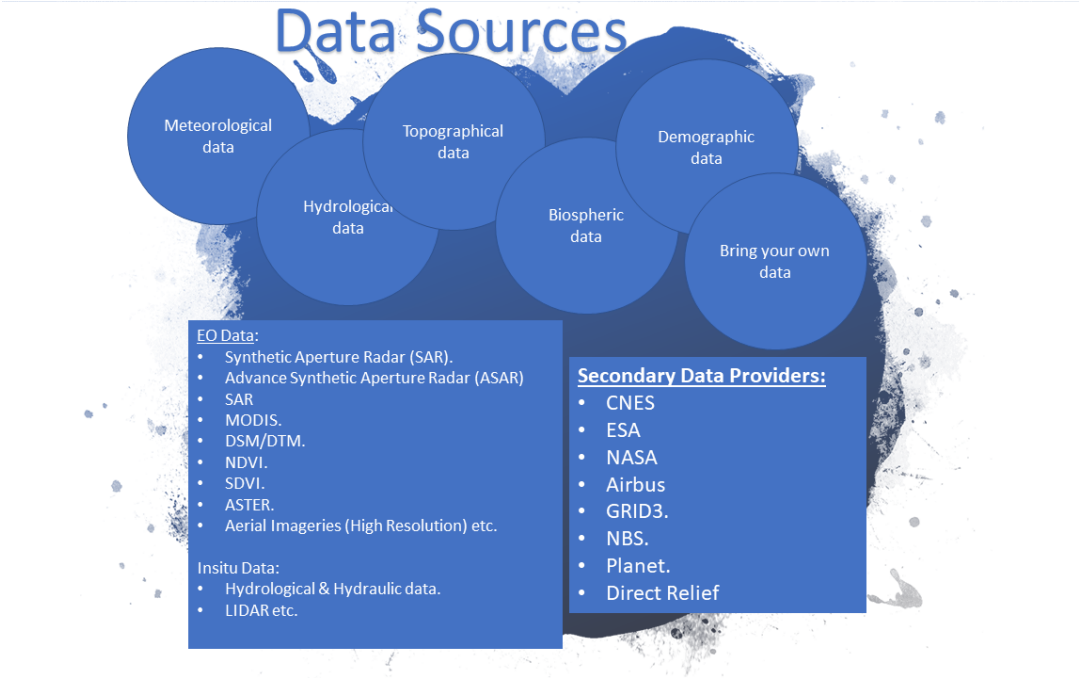
  Here are the list and details of technologies that we will employing their use:

  1. Geographic Information System (GIS): Using Proprietary ESRI ArcGIS Online to serve as our SaaS web mapping & geo-analyst platform, ArcGIS for Desktop & Organisation, ArcGIS for Developers, ArcGIS Business Analyst, ArcGIS Insight, ArcGIS Hub Initiative, ArcGIS Experience & WebApp Builder, ArcGIS App Studio, Leaflet, Open Street Map (OSM) etc. Overall, the GIS technology will be responsible for handling all mapping and geo-spatial analytics of the proposed project.
  2. Remote Sensing & Earth Observatory: NASA Landsat, ESA Sentinel satellite constellation 1,2,3. Caesium 3D, Remote Sensing, Earth Observatory: ArcGIS Scene, Excalibur, Site Scan, Picterra etc.
  3. We are using Artificial Intelligence, Machine Learning & Deep Learning technologies in building our proposed solution, such technologies crucial to end-to-end operational lifecycle of FLOEWS-Disaster for Governance. Therefore, we deploy the service of computer vision image segmentation & classification, convolutional neural network for object identification to be trained imagery samples for disaster affected areas & extent, collapsed buildings/infrastructure etc. this will help speed up identification & assessment of the severity of damages caused by the disaster, population affected, economical losses and post-disaster need assessment etc. We are also using artificial intelligence (AI) & deep learning (DL) for forecasting disaster occurrence using historical data of its occurrence understand
  4. Development:
     - Frontend: HTML, CSS, JavaScript, QML, QML/C++
     - Backend: JavaScript, Python, Arcade, REST, SOAP, XML.
     - Database: SQL (T-SQL), ArcGIS Expression.
     - Scripting & Geo-Processing: Python, R, Arcade.
     - Framework: QT, React etc.
  5. Artificial Intelligence (AI), Machine Learning (ML) & Deep Learning (DL).
     - Conversational Semantics.
     - Chatbots.
     - Programmable Voice and SMS.
     - Contact Center.
  6. Internet of Things (IoT).

- Setup technology as needed i.e., database
  Answer:

  Database Selection:
  Our number database engine choice of is that ArcGIS Catalog, which is an internal built database engine that's embedded inside the ArcGIS for Desktop. The ArcGIS Catalog also has the capability of connecting multiple databases of choice, such as both relational database management system engine (MSSQL Server, MySQL, Oracle database engine, IBM DB, Sybase, Netezza etc.) & distributed databases engines as well as cloud stream data-sources inform of WMST, WMS and other open geo-spatial consortium web-services.
  For the case of this project, we selected Microsoft SQL Server 2021 RDBMS hosted on the cloud for storing our Geo-BigData, together with ArcGIS Catalog, ArcGIS Image Server, ArcGIS Geo-Event & Geo-Analytics Server 10.8.X. The just mentioned that databased engines are all tied up to communicated, collaborate and share resources & workloads together.

  Data Sources:
  Topographical, Hydro-Meteorological, Biospheric data collected primarily and secondarily integrated from satellited such as Sentinel1,2,3, Copernicus emergency services, ESA, NASA, JAXA and Insitu (sensors) and GRID3 are all gathered, clean, geo-enriched and populated into a Geo-Database and ready for binding/integration etc.



- Build, Build, Build!!
  Answer:
  Transitioning from Prototyping to real live development of the solution across all channels e.g., web/mobile/cloud etc.
- Update project management and GitHub
  Answer:
  GitHub & Project Management Repo updated.
- Test features built for the day and make sure they work:
  Answer:
  Solution is tested and functioning as expected.
- Record demo of working features and share with mentor (if you have one) on discord
- Keep track of major issues faced/challenges
  Answer:
  - Working with financial gateway API's from Chimoney was a bit challenging for its my first time working with financial & cryptocurrency API core integrations & development.
  - Time Constraint.
  - Stress.
- Update and submit document: How can your project be improved with AI or data science? What is your chosen technology for your solution?
  Answer:
  Leveraging datasets from satellites, RADAR, Insitu's, and an untapped unique meteorological data source harvested from wireless signals, which are computed together using a powerful GPU and with an industry standard hydrological model, analyse with an artificial intelligence (AI) & machined learning (ML), with the final derived insight being disseminated as an early warning to our customers/beneficiaries via a multi-channel.

  AI & data science in our project are the operational heart of gathering, cleaning, aggregating, analysing and unravelling hidden patterns and trends while using such extracts as actional insight for appropriate decision making. The entire life cycle of our project is bounded by the employment of data science, starting from data gathering\collection to early warning dissemination to citizens and emergency response and promoting the citizens overall resilience to the adherence of natural disaster.

  Investing AI, satellite data & data science in our project development is indeed a great development, for the project is fully developed and functional it will have the capacity equip or benefit Government (Central and municipal governments) to utilizes such AI and satellite images classification processing capability to alleviate damages from natural disasters and provide immediate relief to affected people, which in turns lead to good governance.

Satellite images data and AI analysis will assist governments in making quick decisions after natural disasters, including the identification of houses that have collapsed after earthquakes, assessment of damages to houses due to fires, and detection of flooded areas.

Artificial intelligence and machine learning in emergency situations

AI could have tremendous impact for disaster management, from potentially predicting natural disaster such as flooding, landslide & drought to quickening recovery and response times. AI when integrated in to the development of FLOEWS-Disaster Risk Governance could help governments & humanitarian groups in speeding up map creation by using machine learning to extract objects such as buildings and roads from aerial images.

Artificial intelligence (AI) and machine learning have advanced to the state where they are highly proficient in making predictions and in identification and classification in FLOEWS for Disaster Risk Governance, examples are:

1. **Processing information:** When AI is integrated into FLOEWS for Disaster Risk Governance, it will improve it's used for image recognition of satellite photos to identify damaged buildings, flooding, impassable roads, etc. Multiple data streams can be combined with unreliable data removed and heat maps generated. For example, DigitalGlobe (https: / / www.digitalglobe .com) provides open-source imageries for disaster response, with such at our disposal, our FLOEWS algorithm can learn how to recognize buildings on satellite photos. We can also utilize pre- and post-disaster imagery and utilized crowdsourced data analysis and machine learning to identify locations affected by the natural disaster that had not yet been assessed or received aid.
2. **Emergency calls:** FLOEWS for Disaster Risk Governance integration with AI & ongoing develop FLOEWS Contact Center can during a disaster crisis response help reduce call centers whom are often overwhelmed by surge or traffics. In addition to voice calls, emergencies are increasingly reported by text messages and social media. Such AI and machine learning can be applied to cope with the volume and different types of calls. Another breakthrough is speech-to-text recognition at emergency virtual call centers. The text is input to analytical engine that guides operators on how to respond to the call.
3. **Social media analysis:** Real-time information from Facebook, Twitter, Instagram and YouTube can be analysed and validated by AI to filter and classify information and make predictive analysis. Artificial Intelligence for Disaster Risk Reduction & Response for Good Governance to process the large number of tweets generated during a crisis. The solution will use machine learning to automatically process tweets in real time. FLOEWS semantics engine collects tweets based on hashtags and keywords, and then uses AI to further classify them by topic.
4. **Predictive analytics:** This is the much-anticipated deal of AI's integration in is being used to analyze past data to predict what is likely to happen in disaster risk reduction domain, that's, the ability to predict/forecast accurate before the occurrence of disaster event. FLOEWS processes information from emergency response systems to optimize safe evacuation route. Such data can be integrated on an operational dashboard so that emergency personnel can respond in real time.