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GovChat: A Cornerstone of Digital Government

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Abstract: The rise of government personnel using external social media platforms as communication platform when dealing with official matters has exposed government communication information to data privacy and security concerns. Due to the urgent need for real-time communication among government personnel in the digital workplace, MAMPU has developed GovChat as the first government messaging platform, which connects the government personnel in a private environment. GovChat is a simple and reliable instant messaging application with built-in security and data storage in Public Sector Data Center (MyGovCloud@PDSA). The methodology used in GovChat development was based on a Malaysian Public Sector Application Development Guideline (KRISA). GovChat is developed tailored to the requirements of government agencies with basic and advanced features based on emerging technologies, such as chatbots, image processing for watermarking, and calendar integration. GovChat was gradually rolled out to government agencies beginning in July 2021, with approximately 130 agencies participating to date. GovChat is a digital communication platform aims to support the digital government transformation as outlined in MyDIGITAL Blueprint 2021-2030, and Digitalization Strategic Plan for Malaysia Public Sector 2021-2025.

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1. Introduction

The COVID-19 pandemic in early 2020 has altered nearly every aspect of our lives. According to Ritchie, H., & Roser, M., the way we lived in the past was very different from how we live today [1]. Previously, the business environment was predictable and stable, allowing for long-term planning. In contrast, a constant change in today's living makes the business environment unpredictable and dynamic requiring us to make instant decisions and predict what will happen in the future. Particularly in the public sector, the government has transitioned from working in traditional workplaces to working in new normal digital workplaces [2]. Traditional workplaces required face-to-face and scheduled meetings, a physical workplace for workers, and the sharing of paper-based documents. Whereas a digital workplace necessitates an agile working environment where work no longer takes place, quick decision-making, the use of technology, and real-time communication in a secure environment [3].

Communication is very important, especially when it comes to the digital workplace. This is it is a way of transmitting knowledge to gain a better understanding, exchange thoughts, giving in proper and clear instructions. Based on the digital workplace model by Deloitte [4], in a digital workplace environment "workers prefer newer communication tools, particularly

instant messaging, over more traditional ones like e-mail or team workspaces.". The most obvious reason why instant messaging is preferable to email is the ability to communicate in real-time. Emails are not well suited for short back-and-forth communication because they involve a title and a lengthy and formal paragraph most of the time. Additionally, workers do not always check their emails regularly. An instant messaging platform is a perfect way to exchange information. Members of teams or employees would be able to exchange bits of information without clogging their inboxes. Especially during the pandemic, many organizations have a working-from-home policy, where employees are allowed to not come to the office; instead, they shall stay home and work. Having a meeting and discussion would be easier and more secure with a private messaging platform for the organization. Messaging platforms include features such as video calls, which are instant and bite-sized, making communication easier and faster.

During the pandemic, the rise of government personnel using external social media platforms such as WhatsApp and Telegram when dealing with official matters has led to a worrying situation. The usage of these external platforms could lead to scammers attempting and expose government data to data privacy and security issues. Hence, due to the urgent need for real-time communication among government personnel in the digital world, the Malaysian Administrative Modernisation and Management Planning Unit (MAMPU) has developed GovChat - the first government messaging platform, which connects the government in a secure environment. The development of GovChat is expected to increase the level of confidentiality, integrity, and availability of the government messaging communication data as well as to accelerate the government digital transformation as outlined in Sustainable Development Goal 2030 [5], MyDIGITAL Blueprint 2021-2030 [6], and Digitalization Strategic Plan for Malaysia Public Sector 2021-2025 [7].

This paper discusses the messaging platform concept, GovChat development methodology, features, benefits, and potential enhancements. The remainder of the paper is structured as follows: Section 2 provides a high-level overview of messaging platform concepts. Section 3 describes GovChat's development methodology. Section 4 presents the features of GovChat; Section 5 discusses the benefits of GovChat as well as potential enhancements, and Section 6 draws conclusions and recommendations.

2. Introduction

2.1 Instant Messaging Platform

The ability to communicate effectively is one of the most valuable life skills. Communication has become faster and more efficient as it has transitioned from email to instant messaging applications. Sendmail was the first mail delivery agent, and many others quickly followed [8]. For instance, Postfix. In the early 90s, email spam and computer virus issues became commonplace. To address these issues, these critical Internet Infrastructure Networks needed to be preached, and the underlying protocol had to be modified or in some cases ignored. As a result, the instant messaging platform or application was then established. They are normally centralized networks run by the servers of the platform's operators, unlike peer-to-peer protocols.

Nowadays, some examples of popular messaging applications or platforms are WhatsApp, Facebook Messenger, WeChat, Snapchat, and Telegram [9]. Certain platforms have their architecture and protocols and focus on certain functions. For example, Skype is used mainly for making video calls, meanwhile, an application like WhatsApp focuses more on private and group messaging, and file sharing. Messaging applications or platforms can usually be accessed by smartphones or some of them have website versions as well. Fig. 1 shows the most popular global mobile messenger apps as of January 2022 based on the number of monthly active users (in million) [10]. It can be said that messaging applications have affected the way people communicate on their devices.

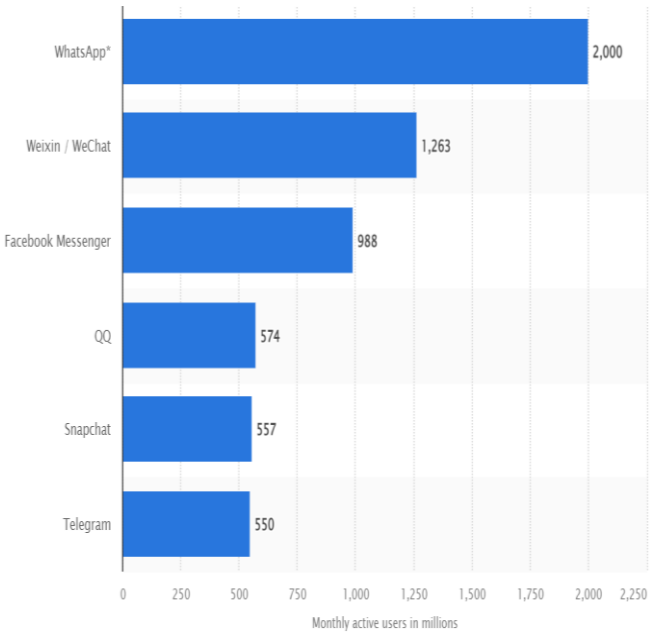

Fig. 1 - Most popular global mobile messaging applications

2.2 Public vs. Private Messaging Platform

There are two types of communications platforms one is the public platform and on the other hand, it's the private communication platform. Public platforms [11] could be defined as social media platforms where people or users can share a lot of personal information. That information will be shared in a public environment.

Whereas a private messaging platform is a platform where users get to choose who they exactly want to communicate with, without sharing any sort of information publicly.

2.3 Enterprise Messaging Platform

As matter of fact, messaging platforms or applications have also changed how people communicate in the workplace. Slack, Tele Message, Team Note, and Yammer, are examples of enterprise messaging applications which allow companies or organizations to enforce policies on how communication at work should be done and to protect the storage of sensitive data. Staff may use message applications or platforms to keep job details apart from personal emails or texts.

Based on a case study on [12] the Government communication tool, where the leading UK government scientific agency needed a critical communications tool to distribute urgent messages to all staff. To start, a leading UK government scientific agency with more than 5000 employees based in their head office and several regionally located operational sites, needed a critical communications tool or platforms to distribute urgent messages to all staff. The platform needs to ensure that critical messages are notified quickly and secured to all employees. The challenge faced by the UK government scientific agency is that the officers, which work in the health and safety field and provide national science advice, deal with a variety of important and fast-moving problems that must be conveyed to the rest of the employees quickly; this means they need to properly monitor communications around these issues to ensure that all relevant employers are fully briefed and that there is an audit trail to support the actions they have taken.

3. Development Methodology

The methodology used in GovChat development was based on the Malaysian Public Sector Application Development Guideline known as KRISA [13]. KRISA is a comprehensive guideline published by MAMPU to assist Malaysian government agencies with software and application development. As shown in Fig. 2, there are six phases of GovChat development initiation, analysis, design, development, testing, and implementation.

3.1 Phase 1: Initiation

The initiation phase is a fundamental phase that involves project planning activities. This phase is critical in establishing the project's direction and framing the project scope so that it is realistic and feasible. During this phase, the GovChat project scope, stakeholders, deliverables, team members, timeline, cost, risk mitigation plan, management, and technical approach were clearly defined. The GovChat application was expected to be completed in five months starting from September 2020, with ten project team members assigned. During this phase, the project governance is also determined, which requires monthly reporting to top management. The document produced during this phase was System Development Plan.

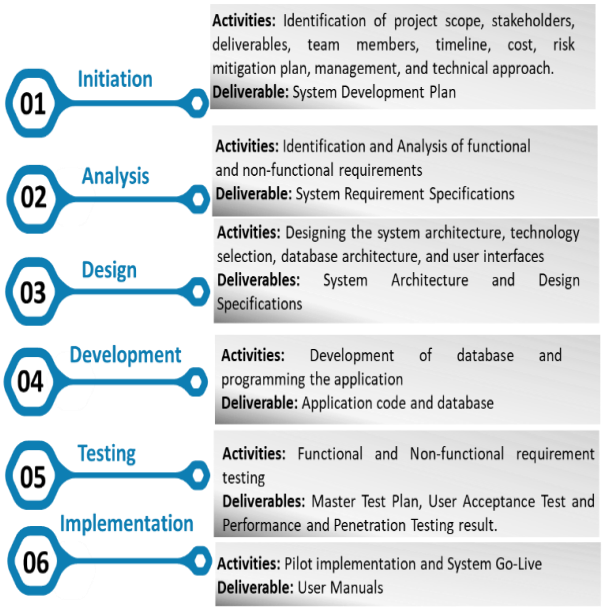

Fig. 2 - GovChat development phases, activities, and deliverables using KRISA

3.2 Phase 2: Analysis

The GovChat application was created as an alternative to using external messaging platforms such as WhatsApp and Telegram by government personnel. Thus, it must be equipped with the basic features of instant messaging apps that users are currently using such as personal direct messages, group conversation, and sharing of text, videos, audio, photos, and documents. In addition, the app needed to meet non-functional requirements such as high performance, compatibility, high availability, and data security. The document produced from this phase was System Requirement Specifications.

The GovChat development for the government appears to be critical in managing instant messaging communication among government personnel. It is also critical to provide a communication platform in a controlled and secure environment within the organization. Several criteria must be considered when developing the enterprise messaging platform for the organization including the architecture whether it is centralized or decentralized, and the security of the applications such as transport layer security, end-to-end encryption, spam protection, and authentication. The data exchanged via the application, such as text, audio, voice-over-IP, videos, and file sharing, must be identified. The application's focus must also be defined, including whether it has features such as private or group channels, one-to-many casting, bulletin to all contacts, unlimited contacts, audio or video calls, and web-based

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support. Fig. 3 indicates some criteria for messaging platform development.

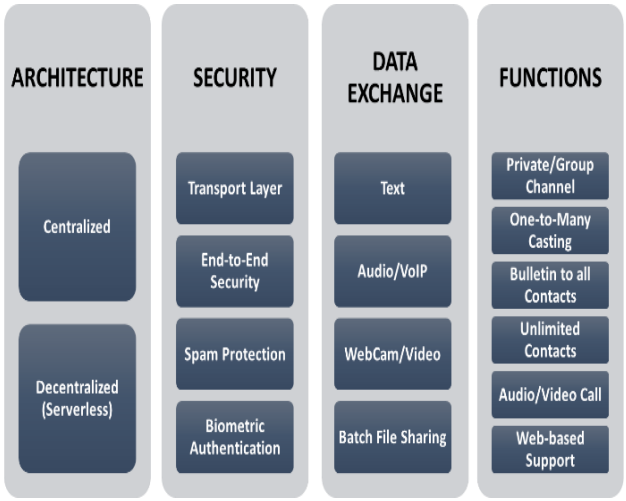

Fig. 3 - Criteria for messaging platform development

3.3 Phase 3: Design

At this stage, the design of the application had been made by identifying the design specifications, the features would be added to the design. Failure at this stage will almost certainly result in the total collapse of the project in the worst-case scenario. The system and database architecture of GovChat was drawn in considering the functional and non-functional requirements that have been stated. Fig. 4 shows the high-level business architecture. Furthermore, System Architecture as shown in Fig. 5 was drawn and the design specifications were elaborated.

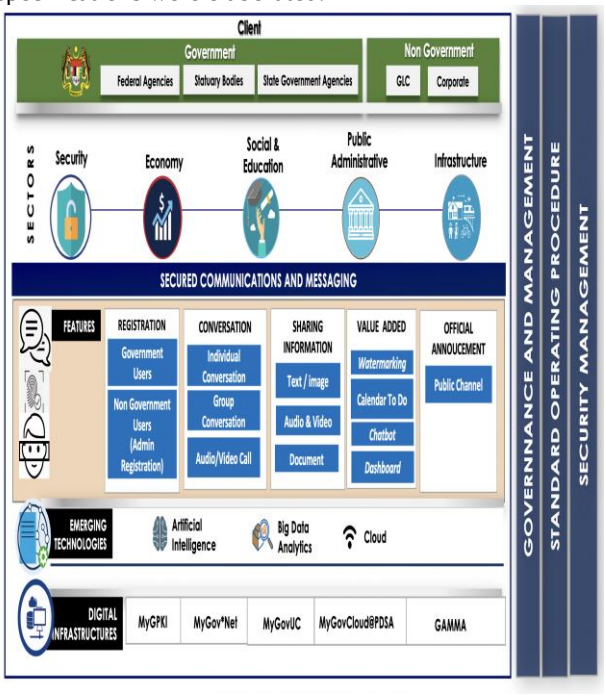

Fig. 4 - High-level Business Architecture

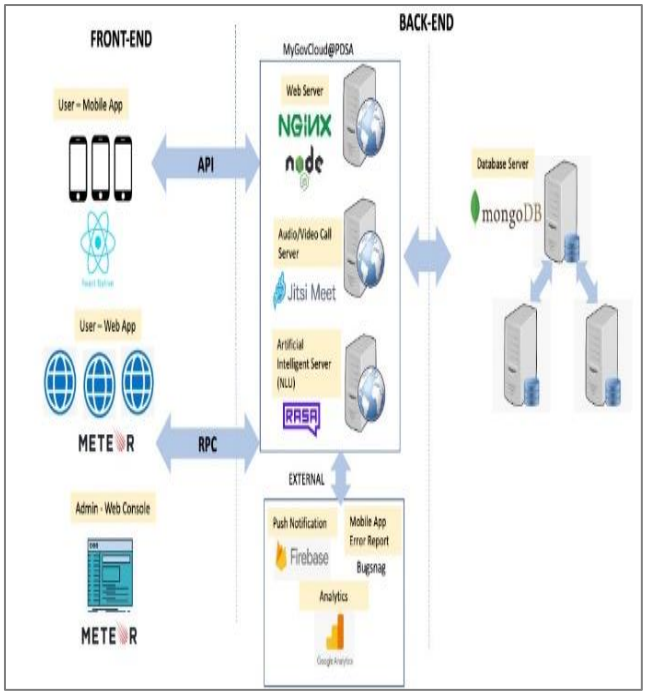

Fig. 5 - GovChat System Architecture

3.4 Phase 4: Development

At this stage, the actual development starts. GovChat was developed in-house using internal ICT resources from ICT Consulting Division, MAMPU. Based on the system architecture drawn in the design phase, GovChat was developed using open-source platforms such as Meteor.js Framework for the web version, React Native for the mobile app, Node.js as the web server, NGINX as the load balancer, and MongoDB for the database. Additionally, Jitsi Meet was set up for video/audio calls and Rasa was used for the Chatbots feature. External integrations with Firebase, Google Analytics, and Bugsnag were implemented for push notification, analytics, and mobile app error monitoring, respectively.During the pandemic situation, the developers were forced to work from home, hence the development tools and communication procedure were set up and flexible hours implementation was applied, daily stand-up meetings to ensure the progress of the development. The GitLab application was used to manage the development works of designing, creating, building, verifying, testing, deploying, and monitoring for scalability, reputation, availability, and replication. With GitLab, the development team knows when the code changes. The deliverables from this phase were the application code and database.

3.5 Phase 5: Testing

The testing phase is required to verify and validate the specification in our requirements [14]. User acceptance testing was performed in order to determine the feasibility of the software followed by non-functional testing such as penetration testing and performance

testing to ensure any security and performance issues of the software were identified and fixed. The deliverables from this phase were the Master Test Plan, User Acceptance Test and Final Acceptance Test result.

3.6 Phase 6: Implementation

At this phase, the application or software is ready to be deployed and to be used by users. The pilot implementation was conducted in MAMPU and National Security Council (MKN), and until October 31, 2022, approximately more than 130 government agencies have embarked on this initiative. GovChat would be improved continuously based on user feedback from the implementation. GovChat Information Portal [15] was also developed as a communication channel to update users about new features, user manuals, how-to-use videos, and about helpdesk facilities. In addition, an operation manual was also produced to facilitate the administration regarding application implementation.

4 Result & Discussion

After going through the development process described above, the first government messaging platform namely GovChat was successfully developed and implemented. As a result, Malaysian government personnel would be able to connect securely, communicate more quickly, and collaborate more effectively with GovChat. The following section elaborates on the features, characteristics, and the advantages of GovChat application in providing secured instant communication among government personnel.

4.2 Simple, Reliable, and User-friendly Apps

The GovChat application was designed to be simple, accessible, and user-friendly. The application can be accessed and installed by government personnel via the GovChat Information Portal as shown in Fig. 6. Government personnel would be able to do self-service registration by registering with valid government email addresses.

Fig. 6 - GovChat Information Portal Landing Page

GovChat presented essential and advanced features of an instant messaging application. There are three categories of conversation: private message, private group, and public group conversation. A private message is a one-to-one communication between two individuals. A private group is a virtual room that only allows selected individuals to communicate in the room. Public sharing of text, videos, audio, photos, and documents. On the other hand, advanced features such as document and image watermarking, calendar integration, and chatbots were also developed and implemented.

4.3 High availability with load-balancing and redundancy

High availability is a computing concept in which a server responds to a user's request with the highest level of reliability possible by utilizing built-in failover mechanisms that mitigate the effects of any one component failing [16]. The high-traffic messaging platform must be able to support hundreds of thousands, if not millions, of user requests in a timely and dependable manner. Hence, a redundant messaging infrastructure in the MyGovCloud@PDSA environment [17] was built for resiliency and high availability of the GovChat application.

The redundancy of the GovChat applications was set up in which, three web servers based on Node.js were configured in supporting the GovChat operation. A load balancer of NGINX was set up to distribute traffic to all of the healthy and connected GovChat web servers using a round-robin algorithm. The load balancer also performs a health check at regular intervals to ensure that GovChat web servers are in good working order. Fig. 7 indicates the architecture of the high-availability GovChat application.

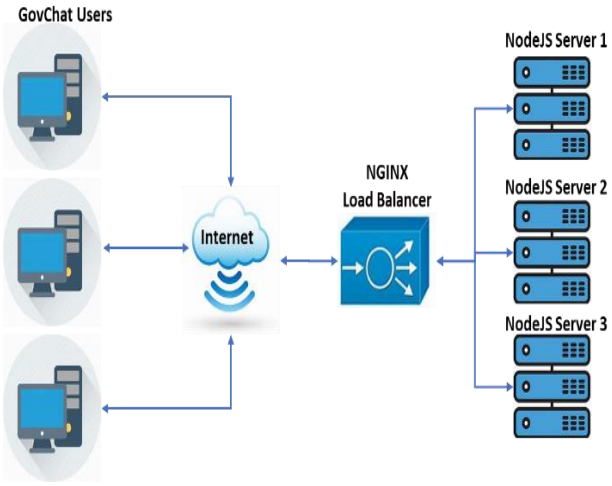

Fig. 7 - High-availability GovChat Architecture

4.4 High-Performance with NoSQL database

GovChat application uses MongoDB as a database to store and manage communication data of the messaging platform. MongoDB is the most popular

NoSQL document database for current developers building high-performance apps. GovChat database infrastructure was set up based on replication as suggested by MongoDB.

Replication in MongoDB is done through replica sets, which allow developers to transfer data from a primary server or node to several secondary servers [18]. This enables the application to conduct some queries on secondary servers rather than primary servers, avoiding conflict and improving load balancing. Replication could improve performance while simultaneously providing redundancy, which increases data availability through horizontal scaling. Figure 8 shows the GovChat database architecture based on the MongoDB replication setup.

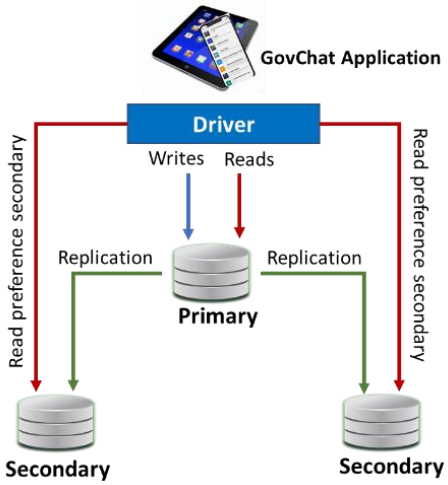

Fig. 8 - GovChat Database Architecture

4.5 Data Security

Data security must be managed to prevent communication from being leaked to unauthorized parties thus, the intrusion should be avoided in the application. Deployed and operated on the MyGovCloud@PDSA environment, all communication data and documents are stored in a government-secured environment. In addition, among security features of GovChat includes authentication, authorization, transport layer security, end-to-end encryption, and audit trail.

GovChat only permits valid email addresses from specific government domains such as gov.my or edu.my for user registration. However, pre-registration by GovChat admin is allowed in some circumstances where users from other domains, such as statutory bodies or government-linked companies, need to communicate using GovChat. To prevent fraudulent use of an email address, when a user registers, an email verification link will be sent to the user's email address. Users must use a password that complies with the MAMPU Cyber Security Policy 2020, which requires a combination of alphabets, numbers, and special characters [19].

4.6 Omni-channel Communication

To increase the accessibility level, the GovChat application was developed in two versions, web version (GovChat web) and mobile version (GovChat app). Fig. 9 shows the GovChat web interface and Fig. 10 shows the GovChat mobile apps interface. GovChat web could use popular web browsers such as Google Chrome, Firefox, Internet Explorer and Safari. GovChat can be accessed and downloaded from GAMMA [20], App Store, and Google Play Store. GovChat apps could be installed and used in smartphone environments such as iOS, Android, Huawei.

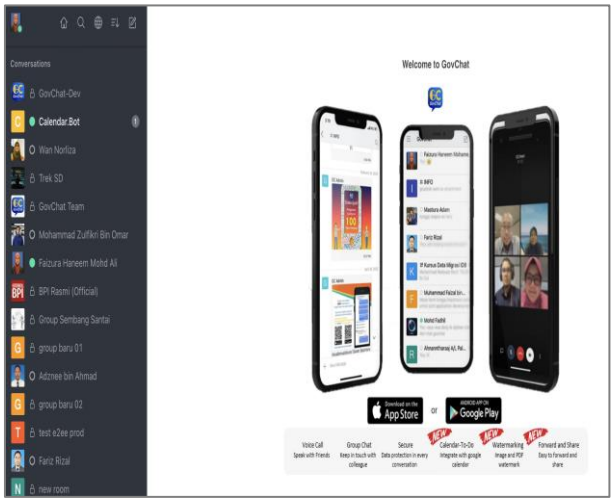

Fig. 9 - GovChat Web Interface

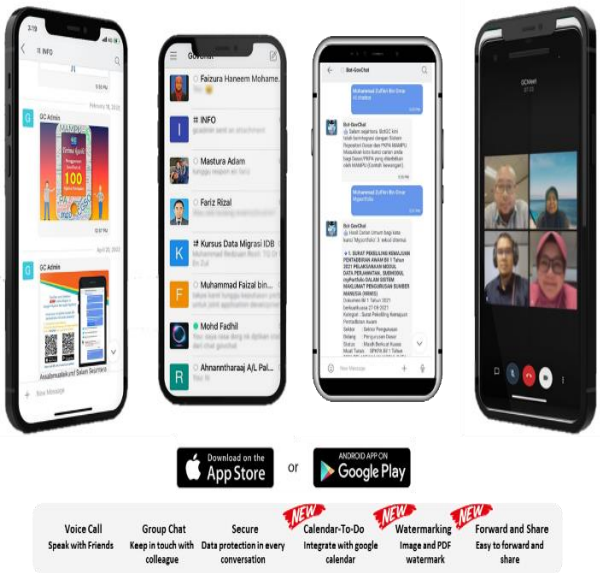

Fig. 10 - GovChat Mobile Apps Interface

GovChat messaging platform uses 'HTTP' as a messaging protocol. All the communication data is stored in a central database without having to download at the client side. Hence, users can login using registered email on both platforms, web, and mobile at the same time independently.

5 Conclusion

Communication is inevitable in any organizations. Realizing the demand for an instant messaging platform for real-time communication in digital workplace, MAMPU has developed the first messaging platform, "GovChat," exclusively to connect government organizations in the digital world. Using the Malaysian Public Sector Application Development Guideline (KRISA) as development methodology, GovChat was developed with best practices techniques and structured approach. With the use of internal expertise and open-source platforms, GovChat has benefited the government of Malaysia in the aspects of cost savings, exclusive and fast communication, and producing a government-owned application. GovChat is an instant messaging application that tailored specifically to the requirements of government agencies, with features ranging from the most essential as private messaging and group chats—to the most cutting-edge, such as Chatbots with Natural Language Understanding (NLU) implementation, image processing for watermarking, and calendar integration. As GovChat already connects government employees aspiring to the digital government agenda, the implementation could be expanded to connect the government with citizens by leveraging GovChat as a communication channel in a digital marketplace where suppliers and consumers are brought together to boost the nation's digital economy.

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