



## Designing a Competent Chatbot to Counter the COVID-19 Pandemic and Empower Risk Communication in an Emergency Response System

Chonnatee Rodsawang<sup>1\*</sup>, Pongsutee Thongkliang<sup>2</sup>, Theeraporn Intawong<sup>1</sup>, Apisit Sonong<sup>1</sup>, Yosita Thitiwatthana<sup>1</sup>, Suthat Chottanapund<sup>3</sup>

1 Division of Innovation and Research, Department of Disease Control, Ministry of Public Health

2 Public Sector Development Group, Department of Disease Control, Ministry of Public Health

3 Bureau of Risk Communication and Health Behavior Development, Department of Disease Control, Ministry of Public Health

\*Corresponding author, email address: chonnatee.r@ddc.mail.go.th

### Abstract

Risk communication is incorporated into an emergency response system. In Thailand, the Department of Disease Control (DDC) manages emergencies through the Emergency Operation Center (EOC). As a part of the EOC, the risk communication unit provides a hotline service that delivers information to and receives complaints and concerns from the general public. During the Coronavirus Disease 2019 (COVID-19) pandemic, a chatbot, which is a type of artificial intelligence (AI) was used to support the hotline service. This paper focuses on how to design an informative chatbot for the COVID-19 pandemic period that disseminates information to the general public. The chatbot, named "COVID-19 Preventable", was created based on the Design Science Research Methodology (DSRM) under two cycles of design and development. At the early stage of development, information from reliable sources was transformed into a question and answer system and imported to natural language processing in the Dialogflow on Google Cloud. The chatbot was the first official chatbot to communicate on COVID-19 on behalf of public health authorities. It consists of seven prompt features, namely, a situation report, how to protect yourself from COVID-19, fake news, self-screening for COVID-19, a list of nearest hospitals, the hotline number to call, and report notification. The uniquely informative and dynamic chatbot is likely to be an alternative channel for disseminating timely information on COVID-19.

**Keywords:** COVID-19, chatbot development, risk communication, Thailand

### Chatbot and COVID-19

Thailand has been confronted with the spread of the Coronavirus Disease 2019 (COVID-19) since January 2020 and was the first country outside of China to report a confirmed case of COVID-19.<sup>1</sup> Staff in charge of the 1422 hotline under the Emergency Operation Center (EOC), Department of Disease Control (DDC), a strategic unit responsible for emergency management has been severely overwhelmed by calls, reflecting the high concern by the general public toward COVID-19.

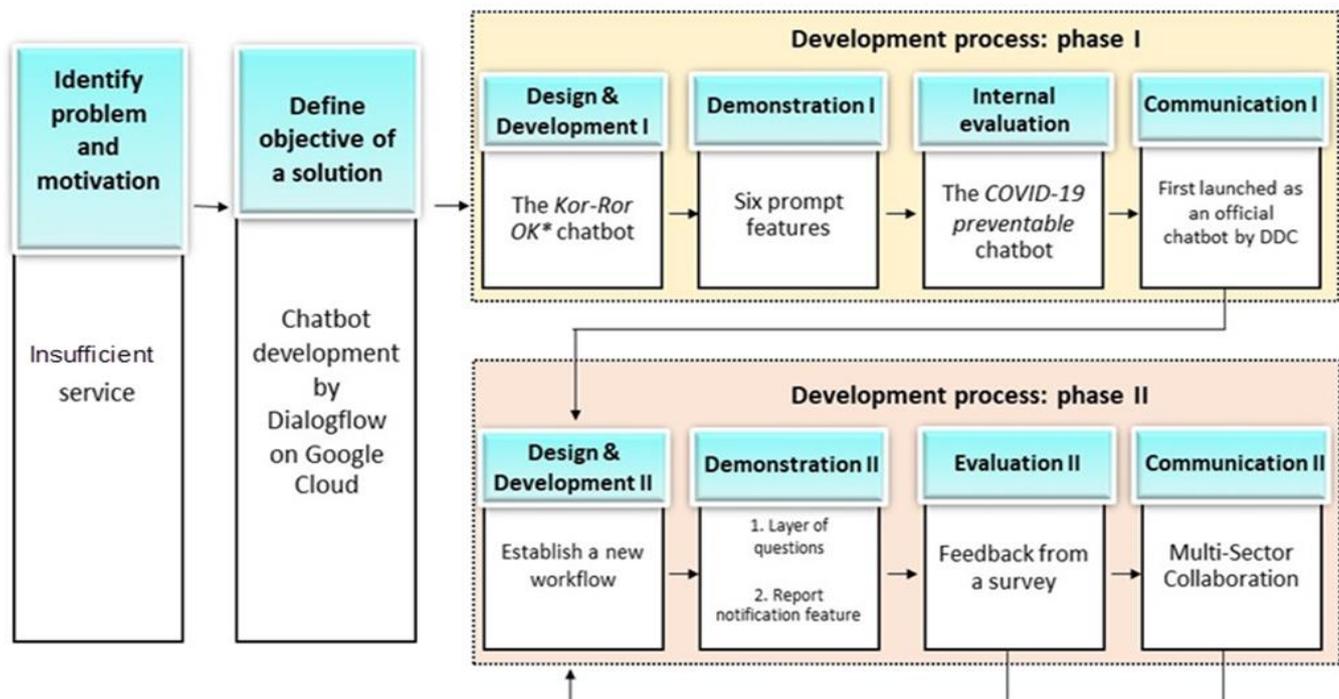
Nowadays, artificial intelligence (AI) technologies, such as formal document completion, requisition response, automatic translations, and document outline, have been applied in various aspects of service

in the government sector.<sup>2</sup> A chatbot is a particular AI technology that mimics human-like conversation through speech or text chats on a messaging platform. Its capabilities have been extensively used in both government and business sectors.<sup>3-5</sup>

The focus of this paper is to describe the development process and to present characteristics of a competent chatbot with an emphasis on COVID-19.

### Development Process

To achieve the objective, the development process was designed based on the Design Science Research Methodology (DSRM), and consists of six steps: identify problem and motivation, define the objective of a solution, design and development, demonstration,



**Figure 1. Process of the chatbot development based on the DSRM. The Chatbot in phase I was named “Kor-Ror OK”, which is the abbreviation (in Thai) for the Department of Disease Control**

evaluation, and communication.<sup>6</sup> This study divided the last four steps into a two-phase development cycle (Figure 1).

### Identify Problem and Motivation

Under the uncertain COVID-19 situation, the number of phone calls to the 1422 hotline service increased noticeably. It is commonly assumed that the public expects truthful information on COVID-19 from public health authorities, including the DDC. However, most of the staff who answers the calls had limited access to information, and therefore could not satisfy the concerns of the caller. A certain level of broad knowledge and information needs to be prepared and organized in a limited time, otherwise it results in inefficient service. An AI tool can access information frequently and quickly and therefore provide answers to a wide range of inquiries that may be beyond a human's ability to remember. Conventional customer service provided via phone calls may be insufficient for people who have high concerns about COVID-19. A new approach is therefore needed to provide a more informative and responsive service.

### Define the Objective of a Solution

To solve these limitations, AI technology, particularly a chatbot, was considered because of its ability to provide practically instant and up-to-date answers to almost every question a person could ask. We believe chatbot was a solution that could handle a larger

number of calls. It is able to handle simple questions and frequently asked questions (FAQs), relieving the burden of the call center. It is also able to monitor calls 24/7 and reduces the time spent communicating with users. Moreover, a chatbot provides 2-way communication that can cater to a massive number of users in a very short time. This project aims to develop a chatbot as a novel approach to provide information on COVID-19.

### Phase I: Design and Development, Demonstration, Evaluation, and Communication

According to the Thailand internet user behavior survey in 2019 conducted by the Electronic Transactions Development Agency (ETDA), the LINE messaging platform was reported as the most widely used online communication application, followed by Facebook Messenger, FaceTime and WhatsApp.<sup>7</sup> Thus, LINE chatbot was justified as an alternative risk communication channel by the DDC.

To deliver in Thailand, LINE chatbot was deployed using Dialogflow on Google Cloud. Dialogflow is a natural language processing (NLP) platform for creating human-like conversational interfaces over 20 languages on websites, mobile applications, and messaging platforms.<sup>8</sup> Initially, the LINE chatbot was named *Kor-Ror OK* (pronunciation of the abbreviation for the DDC in Thai). *Kor-Ror OK* was designed to support staff by searching for information while staff

received calls from people asking questions about COVID-19.

During the early phase of the pandemic, FAQs were responsively added to the Dialogflow. It is important to bear in mind that informative and up-to-date content is likely to be a key factor in convincing and engaging customers to use the chatbot. Information was gathered from public health authorities such as the DDC and the World Health Organization (WHO), other official government websites, and the Thai Public Broadcasting Service (ThaiPBS). According to the Dialogflow's mechanism, the extracted information is uploaded as *intents* that map the user's response.<sup>8</sup> Then, possible statements and their synonyms are created to trigger related intent. This is one reason why a chatbot can mimic a human-like conversation.

*Kor-Ror OK* provided an interactive response with six prompt features that derived from FAQs via the DDC hotline, namely, situation report, how to prevent yourself from COVID-19, fake news, self-screening for COVID-19, a list of nearest hospitals, and the 1422 hotline number to call (Figure 2). Then, *Kor-Ror OK* demonstrated its ability as a responsive system for providing instantaneous content related to COVID-19 in both Thai and English. This step highlighted the advantages and practicability of *Kor-Ror OK* to the

hotline staff and internal stakeholders. As simulated chatbot users, they evaluated and gave useful and productive comments. For example, the user interface should focus on ease of access and represent public health authorities, not only the DDC.

After the first round of internal evaluations, *Kor-Ror OK* was promoted as an officially dedicated chatbot not only for staff but also for the public on 27 Feb 2020. Later, policymakers renamed the chatbot to COVID-19 Preventable (COVID-19 ป้องกันได้) to communicate to the public that COVID-19 is preventable.

**Phase II: Design and Development, Demonstration, Evaluation, and Communication**

After the number of users reached over 100,000, the menu usage rose remarkably. The number of complex questions that were needed accumulated gradually. These challenging problems, which arose in Phase I, were categorized and considered carefully. Consequently, two solutions were proposed to solve these problems. Complex questions were analyzed and classified into two main types of questions, namely unmatched questions and unanswered questions. Two academic teams were assigned responsibility for information management.

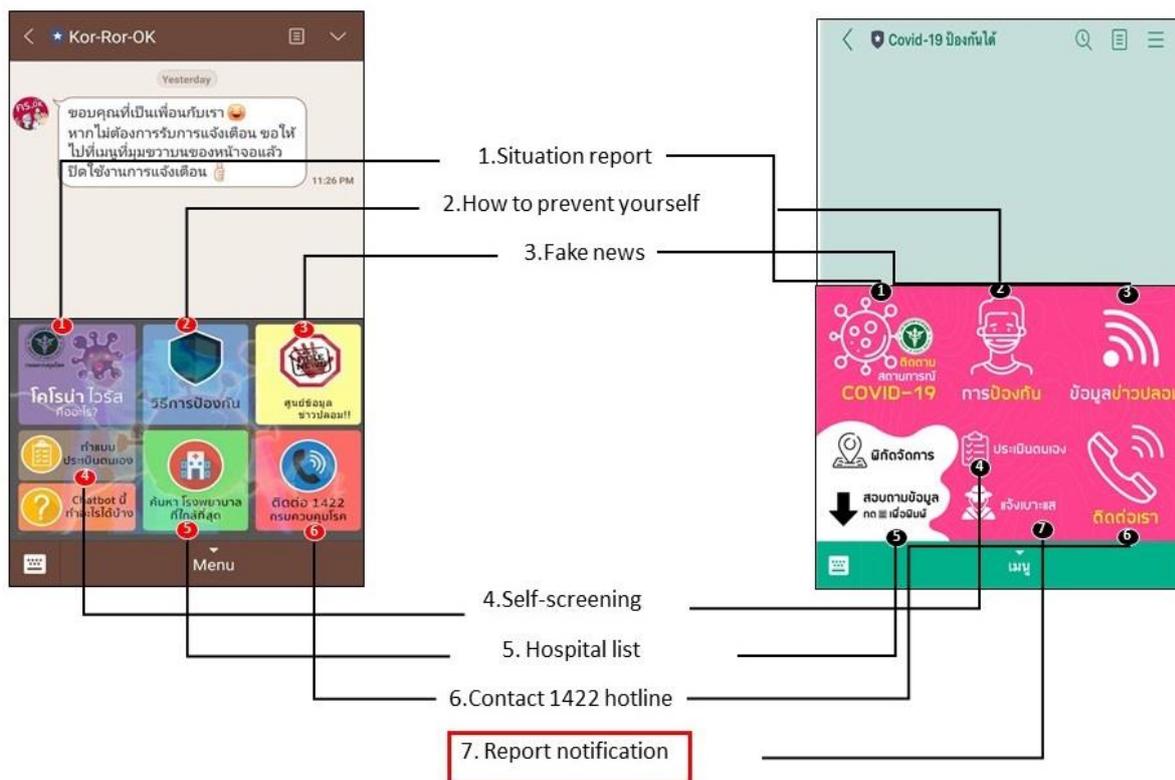


Figure 2. Six menu icons of the initial "Kor-Ror OK" chatbot (left) and seven menu icons of the latest version: the "COVID-19 Preventable" chatbot (right)

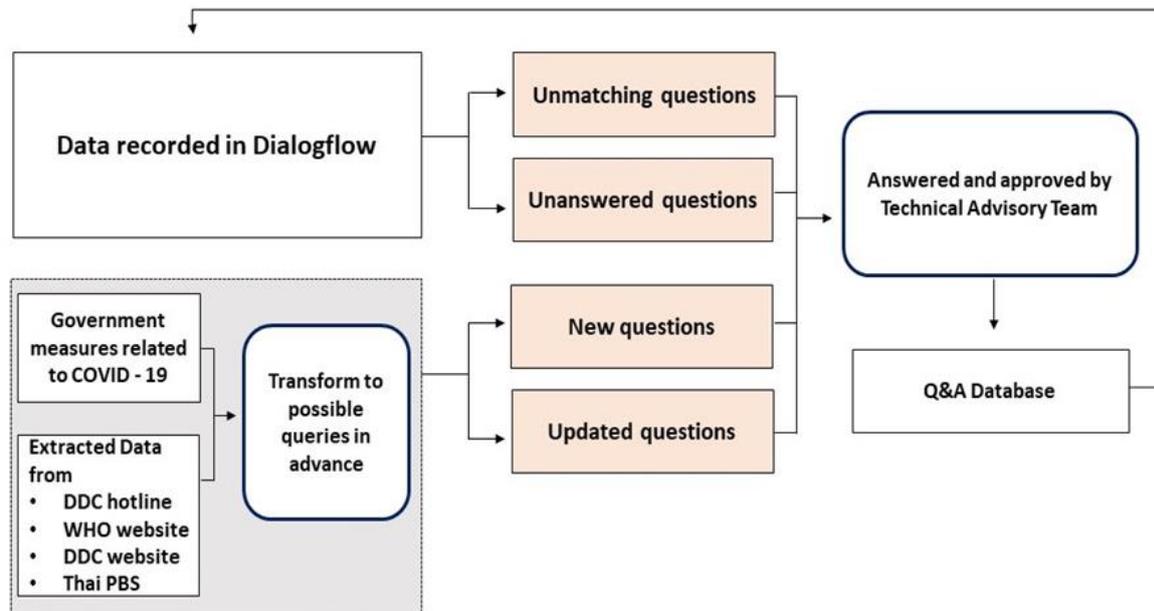


Figure 3. The workflow for organizing information to the Dialogflow

The first team was assigned to respond to the Dialogflow configuration of unmatched questions and answers. Meanwhile, the second team was assigned to deliberate on answering a backlog of questions that relied on academic principles (Figure 3).

The teams conducted brainstorming sessions to design new features to provide a more effective answer by obtaining the four most frequent user groups of choice.

Moreover, it was decided that the information in the chatbot should be updated daily following announcements from the Thai government via the Centre for Covid-19 Situation Administration (CCSA). It was deemed necessary to establish a workflow to extract core contents of announcements or measures from the CCSA daily including relevant information from reliable sources and then transform them into pairs of questions and answers (Figure 3).

Approximately, three hundred imported questions could be classified into four sections: section 1) general knowledge, section 2) ways to control COVID-19 and prevent oneself from being infected, section 3) travel advisories, section 4) the Communicable Disease Act 2015. Users could find more specific answers by choosing each layer of questions (Figure 4). This new feature seemed to help users easily find answers to expected questions.

As a consequence of the government announcement about the Communicable Disease Act 2015 (B.E. 2558) and the Emergency Decree, many notifications of violations were reported via the LINE chatbot. For example, potentially infected people who were

observed and needed to be quarantined according to the DDC guideline. As a result, a new feature menu “report notification” was designed and integrated into the chatbot to support reporting from people concerning the spread of COVID-19 immediately and then forwarded to designated sections for immediate action. Initially, the report notification menu used Google Forms to facilitate data collection and inform users to the designated sections, such as the EOC. The report notifications may lead to prompt investigation of COVID-19. Currently, the report notification is being developed under ArcGIS Online, a Cloud-Based GIS Mapping Software which reports violations by location.

After two months, two new features, which were question categories and report notification, were demonstrated to the hotline staff and stakeholders. To evaluate these features, an online survey was sent to a random sample of chatbot users. Their feedback was analyzed and used to make improvements. The latest version of the chatbot was proposed at the DDC executive meeting, which was attended by designated government sectors following the Emergency Decree to take actions in their roles.

## Results

The “COVID-19 Preventable” chatbot is one of the official interactive channels used by the DDC to deliver risk communication on COVID-19 and contains 262 pre-programmed questions in Thai (43 in English). Currently, there are over 500,000 users with the number of requests per day peaking at 10,000. The



## Limitations

All members of the chatbot development team were government officers employed at the DDC as doctors or public health officers, thus, their expertise was generally related to public health knowledge in terms of epidemiology and disease control principles. However, they had no expertise in AI or chatbot development.

As a result, a lack of technical skills to create a high-potential chatbot providing complete user satisfaction may be one of the limitations of this project. For example, feature menus are not desktop-friendly, and speech recognition is not fully functional. To solve these problems, a technical collaboration between AI specialists and the DDC team is encouraged.

## Future Recommendations

We aim to improve the chatbot's accessibility by establishing access on Facebook Messenger and WhatsApp. Another possible area of future development would be to translate the contents to other languages and add more information for the resilience stage of spread and vaccination. According to the survey results, the DDC website was the most popular among other channels of the DDC. Therefore, embedding the chatbot in the DDC website should be considered by policymakers. Similar chatbots could also be applied for the dissemination of general knowledge to control other diseases.

## Implications

Amid the emergency circumstances of the COVID-19 crisis, the development of an innovative chatbot that can provide risk communication to the public is timely. A focus on developing the chatbot to be more informative and dynamic may improve user satisfaction. Moreover, to engage more users to the chatbot, the developers should establish an appropriate workflow, containing organized and accurate information to ensure that risk communication under crisis is delivered to make user's satisfaction. The usefulness of this chatbot may be to apply to mitigate and relieve the burden of concerns affecting public health staff during a crisis.

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## Suggested Citation

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