

# Programming Tools for Messenger-Based Chatbot System Organization: Implication for Outpatient and Translational Medicines

Abashev A., Grigoryev R., Grigorian K., Boyko V.  
Kazan Federal University, 420008, Kremlevskaya 18, Kazan, Russia

---

## Abstract

© 2016, Springer Science+Business Media New York. The implementation of translational medicine is associated with considerable costs of equipment, staff competence, and doctor-patient (DP) and clinic-patient (CP) communication. The application of DP and CP systems evolved from e-mail letters to website assistance chat and smartphone apps in the context of the m-health paradigm. The rapid development of mobile messengers and chatbot systems has opened a new niche for DP and CP communication, providing a high population penetration rate with perfect capabilities for personalization. This article provides a model of chatbot system organization as well as programming tools for its implementation. The integration of machine conversation systems supplemented by natural spoken language together with m-health devices and mobile apps is a good solution for a variety of tasks in translational and outpatient medicine. The usage of chatbot systems as a communication device for the purposes of translational medicine is going to reduce costs and time on routine operations.

<http://dx.doi.org/10.1007/s12668-016-0376-9>

---

## Keywords

Ambulatory medicine, Artificial intelligence, Chatbot, Communication, Outpatient medicine, Translational medicine

## References

- [1] Montano, M. (2014). *Translational biology in medicine*. Elsevier.
- [2] Fiebach, N. H., Barker, L. R., Burton, J. R., & Zieve, P. D. (2007). *Principles of ambulatory medicine*. Lippincott Williams & Wilkins.
- [3] Westerman, G., Bonnet, D., & McAfee, A. (2014). The nine elements of digital transformation. *MIT Sloan Manag Rev*, 7.
- [4] Andal-Ancion, A., Cartwright, P., & Yip, G. S. (2003). The digital transformation of traditional business. *MIT Sloan Manag Rev*, 44(4), 34-41.
- [5] Gaster, B., Knight, C. L., Witt, D. E., Sheffield, J. V., Assefi, N. P., & Buchwald, D. (2003). Physicians' use of and attitudes toward electronic mail for patient communication. *J Gen Intern Med*, 18(5), 385-389. doi:10.1046/j.1525-1497.2003.20627.x.
- [6] Ye, J., Rust, G., Fry-Johnson, Y., & Strothers, H. (2010). E-mail in patient-provider communication: a systematic review. *Patient Educ Couns*, 80(2), 266-273. doi:10.1016/j.pec.2009.09.038.
- [7] Spielberg, A. R. (1998). On call and online: sociohistorical, legal, and ethical implications of e-mail for the patient-physician relationship. *JAMA*, 280(15), 1353-1359. doi:10.1001/jama.280.15.1353.

- [8] Hu, D.-Y. (2016). Mass prevention and treatment: fundamental strategy for chronic disease control and prevention. *Chronic Diseases and Translational Medicine*. doi:10.1016/j.cdtm.2016.03.001.
- [9] Swan, M. (2009). Emerging patient-driven health care models: an examination of health social networks, consumer personalized medicine and quantified self-tracking. *Int J Environ Res Public Health*, 6(2), 492-525. doi:10.3390/ijerph6020492.
- [10] Bastawrous, A., & Armstrong, M. J. (2013). Mobile health use in low-and high-income countries: an overview of the peer-reviewed literature. *J R Soc Med*, 106(4), 130-142. doi:10.1177/0141076812472620.
- [11] Xu, X., Akay, A., Wei, H., Wang, S., Pingguan-Murphy, B., Erlandsson, B.-E., et al. (2015). Advances in smartphone-based point-of-care diagnostics. *Proc IEEE*, 103(2), 236-247. doi:10.1109/JPROC.2014.2378776.
- [12] Bates, M., & Zumla, A. (2015). Rapid infectious diseases diagnostics using smartphones. *Annals of translational medicine*, 3(15). doi:10.3978/j.issn.2305-5839.2015.07.07.
- [13] Carrara, S., Baj-Rossi, C., Ghoreishizadeh, S. S., Riario, S., Surrel, G., Stradolini, F., ... Dehollain, C. (2015). Full system for translational studies of personalized medicine with free-moving mice. In Paper presented at the 2015 I.E. International Symposium on Circuits and Systems (ISCAS).
- [14] Gollamudi, S. S., Topol, E. J., & Wineinger, N. E. (2016). A framework for smartphone-enabled, patient-generated health data analysis. *PeerJ Preprints*, 4, e1911v1911. doi:10.7287/peerj.preprints.1911v1.
- [15] Tagliamonte, S. A., & Denis, D. (2008). Linguistic ruin? LOL! Instant messaging and teen language. *American speech*, 83(1), 3-34. doi:10.1215/00031283-2008-001.
- [16] Walton, N. (2014). Chat apps will disrupt global telecoms sector. *The Oxford Analytica Daily Brief*.
- [17] Baron, N. S. (2004). See you online gender issues in college student use of instant messaging. *J Lang Soc Psychol*, 23(4), 397-423. doi:10.1177/0261927X04269585.
- [18] Schiano, D. J., Chen, C. P., Isaacs, E., Ginsberg, J., Gretarsdottir, U., Huddleston, M. (2002). Teen use of messaging media. In Paper presented at the CHI'02 extended abstracts on Human factors in computing systems.
- [19] Shawar, B. A., & Atwell, E. S. (2005). Using corpora in machine-learning chatbot systems. *International journal of corpus linguistics*, 10(4), 489-516. doi:10.1075/ijcl.10.4.06sha.
- [20] Turing, A. M. (1950). Computing machinery and intelligence. *Mind*, 59(236), 433-460. doi:10.1007/978-1-40-0-6710-5\_3.
- [21] Person, N., Graesser, A. C., Group, T. R. (2002). Human or computer? Autotutor in a bystander turing test. In Paper presented at the International Conference on Intelligent Tutoring Systems.
- [22] Hutchens, J. L. (1996). How to pass the Turing test by cheating. School of Electrical, electronic and computer engineering research report TR97-05. Perth: University of Western Australia.
- [23] Batacharia, B., Levy, D., Catizone, R., Krotov, A., Wilks, Y. (1999). CONVERSE: a conversational companion Machine conversations (pp. 205-215). Springer.
- [24] Shawar, B. A., Atwell, E. (2002). A comparison between ALICE and Elizabeth chatbot systems.
- [25] Rubin, V. L., Chen, Y., & Thorimbert, L. M. (2010). Artificially intelligent conversational agents in libraries. *Library Hi Tech*, 28(4), 496-522. doi:10.1108/07378831011096196.
- [26] Marciel, K. K., Saiman, L., Quittell, L. M., Dawkins, K., & Quittner, A. L. (2010). Cell phone intervention to improve adherence: cystic fibrosis care team, patient, and parent perspectives. *Pediatr Pulmonol*, 45(2), 157-164. doi:10.1002/ppul.21164.
- [27] Crutzen, R., Peters, G.-J. Y., Portugal, S. D., Fisser, E. M., & Grolleman, J. J. (2011). An artificially intelligent chat agent that answers adolescents' questions related to sex, drugs, and alcohol: an exploratory study. *J Adolesc Health*, 48(5), 514-519. doi:10.1016/j.jadohealth.2010.09.002.
- [28] Abraham, A. (2005). Rule-Based expert systems. *Handbook of measuring system design*.
- [29] Agostaro, F., Augello, A., Pilato, G., Vassallo, G., Gaglio, S. (2005). A conversational agent based on a conceptual interpretation of a data driven semantic space. In Paper presented at the Congress of the Italian Association for Artificial Intelligence.
- [30] Ghose, S., Barua, J. J. (2013). Toward the implementation of a topic specific dialogue based natural language chatbot as an undergraduate advisor. In Paper presented at the Informatics, Electronics & Vision (ICIEV), 2013 International Conference on.
- [31] Edoja, D. (2011). Method, system and program for data delivering using chatbot: Google Patents.
- [32] Akka Java documentation. <http://akka.io/docs/>
- [33] ElasticSearch Java API documentation. <https://www.elastic.co/guide/en/elasticsearch/client/java-api/current/index.html>
- [34] Java Telegram bot API documentation. <https://github.com/rubenlagus/TelegramBots>
- [35] Kuhn, R., Hanafee, B., Allen, J. (2014). *Reactive design patterns: Manning publications*.

- [36] Fan, A. Z., Li, Y., Elam-Evans, L. D., & Balluz, L. (2013). Drinking pattern and blood pressure among non-hypertensive current drinkers: findings from 1999 to 2004 National Health and Nutrition Examination Survey. *Clin Epidemiol*, 5, 21-27. doi:10.2147/clep.s12152.
- [37] MyStem documentation. <https://tech.yandex.ru/mystem/>
- [38] Segalovich, I. (2003). A fast morphological algorithm with unknown word guessing induced by a dictionary for a web search engine. In Paper presented at the MLMTA.
- [39] Wilbur, W. J., & Sirotkin, K. (1992). The automatic identification of stop words. *J Inf Sci*, 18(1), 45-55. doi:10.1177/016555159201800106.
- [40] Mikolov, T., Chen, K., Corrado, G., Dean, J. (2013). Efficient estimation of word representations in vector space. arXiv preprint arXiv:1301.3781.