Development of a chatbot for informing students of the schedule

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Abstract. The article describes the process of developing a chatbot to provide students with information about schedules using the Telegram mobile messenger. During the research, the following tasks have been performed: the analysis of notification systems for their use in the educational process, identification of problems of notifying students about the schedule (dynamic environment, traditional presentation of information, lack of round-the-clock access), substantiation of the choice of mobile technologies and Telegram messenger, determination of the requirements to the software, generalization of the chatbot functioning features, description of the structure, functionality of the program to get information about the schedule using a chatbot. The following tasks have been programmatically implemented: obtaining data from several pages of a spreadsheet (faculty / institute, red / green week, group number, day of the week, period number, discipline name, information about the teacher); presentation of data in a convenient form for the messenger (XML); implementation of the mechanism of convenient presentation of data in the messenger (chatbot). Using Python and the Telegram API, the software has been designed to increase students; immediacy in getting the information about the schedules, minimizing the time spent, and optimizing of planning of student activities and higher education institution functioning.

Keywords: chatbot, schedule, mobile applications, API, Telegram, Python, XML.

1 Introduction

Setting up an effective notification for students about the classes schedule is a problem that leads to the development of convenient and effective tools. There were attempts to develop programs and systems for automated scheduling. In particular, with the use of genetic algorithms, Wilhelm Erben and Jürgen Keppler [4] developed a specific chromosome representation and knowledge-augmented genetic operators that “intelligently” avoid building illegal timetables. The prototype timetabling system which is presented has been implemented in C and PROLOG, and includes an interactive graphical user interface and was tested using real university data, which produced promising results. Yulan He, Siu Cheung Hui and Edmund Ming-Kit Lai [6] claim that their approach based on artificial immune system gives better results in creating automated individual schedules than those obtained with a genetic algorithm. For automatic scheduling developers [13] also use a network flow algorithm to match resources and assign them to classes. As a result, the schedule control application automatically generates class schedules, with consideration to resources and limits specified by user. The algorithm used to generate the schedules is based on Ford-Fulkerson algorithm. The application aggregates data and sends to the algorithm as the input via XML. The algorithm generates classes in the schedules in the form of XML. The application allows the user to select one schedule out of three presented schedules, modify and finally export it. It is expected that time spent on the whole schedule publication process is reduced due to the reduction in time spent on the sub-process, and errors are kept low comparing to manual work. Using the features of Google Calendar, Illia V. Oleksiienko and Vasyl M. Franchuk [18] have developed a web-based system for entering and viewing an electronic class schedule for a higher education institution. The Malaysian scientists' solution is interesting and effective [11], they offered a model of university courses' scheduling using an ant colony optimization algorithm as a powerful approach to solving various combinatorial optimization problems.

However, the problem of informing students about the schedule of classes and its changes is not sufficiently explored. Some studies have examined notification systems and their use in the learning process:

- a portable organizer device through which a student may use and maintain a personal calendar [10];
- the learning notification express delivery service which provides students with information about their learning status, follow-up activities, and more [22];
- mobile agent-based event notification system [3];
- an online reference and notification system for college students based on individual user profiles [2];
- students attendance system and notification of college subject schedule based on IBeacon use [7] and more.

2 Problem statement

In higher education institutions, class schedules play a major role in the daily lives of students, faculty, and staff, informing about the time and place of study. Changes can occur when a schedule is formed in a dynamic environment such as school. The question arises as to how to promptly inform students about the stationary schedule and changes in it.

Nowadays, the schedule notification system is traditional: a paper version on the bulletin board for students and at the department for teachers or at an electronic educational institution. It is not always convenient for students to use a paper version that does not have 24-hour access. It is also inconvenient to use a photo taken on a mobile phone: it is hard to navigate, it is easy to lose the photo of a schedule among many photos on a mobile phone, it is impossible to receive notification about changes in the schedule.

It is advisable to use the most commonly available online programs and services for developing a notification system, so that students can receive timetable information promptly. As stated in We Are Social and Hootsuite [8], the proportion of Internet users using mobile phones and the proportion of mobile messenger users is increasing worldwide. According to a study [12] by the Mobile Marketing Agency LEAD9 and the Kiev International Institute of Sociology, the most popular messengers among Ukrainians are Viber, Facebook, Skype and Telegram. Using Facebook and Skype to develop a timetable retrieval system is not appropriate because only few students use these messengers on mobile phones. Therefore, it is advisable to use the capabilities of messengers such as Viber or Telegram.

3 Mobile technologies in the educational process

Mobile technologies in the educational process of higher education institutions are most commonly used for the organization of mobile learning. Use of a mobile device for didactic purposes is possible for: 1) student's work remotely; 2) delivery of educational materials; 3) testing the course knowledge. Remotely, the student may perform certain educational or research work on a teacher's assignment. Sending training materials today depends on the type of mobile phone and the technologies it supports. The most up-to-date mobile devices use Opera Mini, Internet Explorer Mobile, Safari, etc. to browse the web are fairly capable of displaying readable text and graphics [19]. Cloud-based learning environment built on the integrative usage of mobile Internet devices promotes the forming of Bachelor's of Electromechanics professional competencies [15; 16; 17].

Mobile learning is based on the intensive use of modern mobile tools and technologies. It is also linked to learning mobility in the sense that students should be able to participate in educational activities without restrictions in time and space [21]. Therefore, the timely receipt by students of schedule information and schedule changes has a direct relation on the effectiveness of the educational process. Therefore, the development and use of software to enable this are appropriate.

4 Defining software requirements

Given that the schedule is presented in Google Sheets format embedded in the website, the task is:

1. get data from several pages of the spreadsheet (faculty / institute, red / green week, group number, day of the week, pair number, discipline name, teacher information);
2. submit them in a convenient form for the messenger;
3. implement a mechanism for convenient presentation of data in the messenger.

An interesting solution to this problem is the software solution given in the work [9], which presents a process for extracting AIML (artificial intelligence markup language) chatbot knowledge bases from a text corpora using the AGATA (Automatic Generation of AIML from Text Acquisition) system, designed to facilitate and reduce the time needed in that task. The study consisted of converting the contents of two textbooks into AIML and sending the files to a chatbot knowledge base. This technology allows teachers to easily create their own chats according to the topics of the course.

Based on this research and the research discussed above, the chatbot, that retrieves data from electronic documents with schedule information using a high-level program that extracts them into an XML file and it provides the user with scheduling information as requested by the messenger API, is set out to be created.

Given that Viber chatbots are paid [20], we have chosen the Telegram messenger to develop a chatbot for scheduling information.

5 Features of chatbots functioning

Setting up an effective notification of students about the classes schedule is a problem that leads to the development of convenient and effective tools.

Currently, according to an OpenMarket study [14], 77% of US consumers are more positive about text messaging companies, and 64% of Internet users prefer texting rather than voice messaging. These circumstances prompted the development of chatbots. The formation of artificial intelligence as a new research direction has stimulated the development of modern Intelligent Information Systems (IIS) and intelligent information technologies, which have found applications in almost all areas of human activity, providing automation of manufacturing processes, improving the effectiveness of management and training, in the development of ontologies, Knowledge Bases (KB) and in other cases [5].

A chatbot is a program that provides people with the service of communication through artificial intelligence. Chatbots are designed to work with virtual assistants. They themselves provide a platform for the promotions of the Products and Services online [1]. The use of chatbots is gaining popularity in several sectors: medicine, economics, psychology, sociology, etc. However, in the educational field, chatbot is rarely used as an assistant in training, education or organization of the educational process.

The process of using chatbots in messengers is pre-programmed based on appropriate databases of user interaction, sometimes in complex systems using artificial intelligence. Some chatbots use sophisticated natural language processing systems, but many simpler ones scan for keywords in typed text or a voicemail and then retrieve the answer with the most relevant keywords or most similar formulation template from the database. With the help of a chatbot, the user can get answers to questions, information about specific requests, recommendations, psychological support and more. The value of chatbots in dialog systems is their high engagement, responsiveness, and ability to automate basic user interaction processes.

6 Description of the developed application for obtaining schedule information using a chatbot

In accordance with the Python programming language requirements, an application was developed to retrieve the data from the spreadsheet csv-pages and convert them to xml format to further use the Telegram API. The application in its structure has:

1. Python (.py) files – a chatbot application file, a program file to update schedule information, and a basic interaction file for all application elements;
2. folder with xml-files – a list of disciplines, teachers, students and schedule;
3. folder with Python files for retrieving csv files and csv processing results.

Xml files with schedule information and discipline list are updated upon request. Schedule data is downloaded from Google Drive, which stores the schedules of all departments. To make the application work the list of teachers and students with relevant data should be made. For the teachers list: the department where the teacher works, the code, the surname, first name and patronymic of the teacher. For the student list, the group number, surname, first name and patronymic of the student. The xml file with the schedule information contains the following entries: day of the week (number), group number, pair number, subject code (and list of subjects), teacher code (from the list of teachers), office number.

To run the application, the chatbot application must work on a computer connected to the network or on a web host. The Telegram messenger must be installed on the user's mobile phone and the user needs to access the @mr_raspisane_bot chatbot. After joining the chatbot, pressing the START button in the Telegram chat starts the chatbot. The user sends a message to chatbot and it sends it to the main Telegram server, which sends it to the computer or hosting that runs the chatbot. Everything is processed there and the answer is returned in the reverse order to the user (Fig. 1).

The following Python language modules and libraries were used to develop the chatbot application:

1. standard: os – provides functions to work with the operating system; datetime – provides classes for processing time and dates in various ways; xml.etree.ElementTree – API implementation for working with XML files in Python; csv – implements classes for reading and writing tabular data in .csv format;
2. not standard: telebot – a library of Telegram bots with simple route decorators, distributed under the MIT license for free software; wget – allows downloading the contents of files located at a certain url; openpyxl – Python library for reading / writing Excel 2010 files xlsx / xlsm / xltx / xltm;
3. designed: raspisanie – with features for finding a group number, discipline name, teacher information, and classroom.

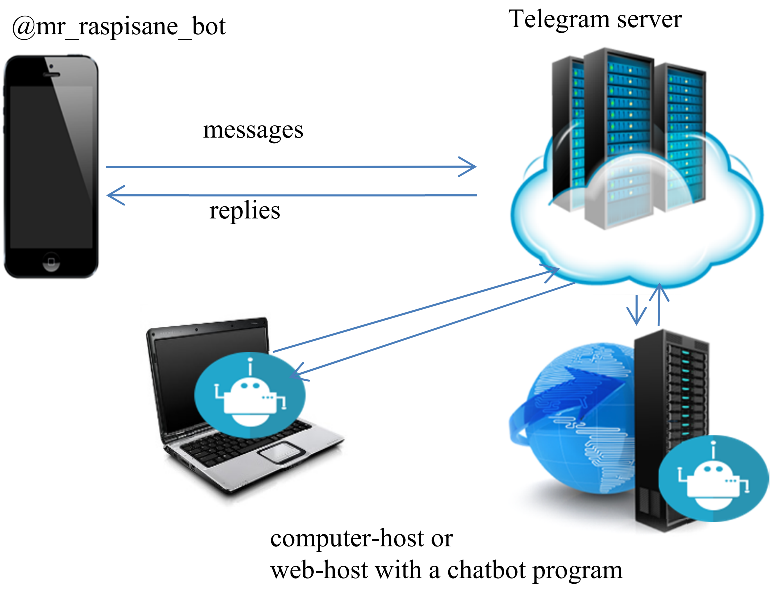


Fig. 1. Functional diagram of the chatbot (image for the scheme is taken at https://www.google.com/imghp with a re-use license)

The following is a snippet of raspisanie.py module code that allows you to find the class by name (parser_uchen function), name of the subject (function parser_predm), teacher information (function fio_prep) and student information (poisk_w_baze function):

```
import xml.etree.ElementTree as ET

import datetime

#finds a class by name
def parser_uchen(wr_fio):
    tree = ET.parse('xml/Uchen.xml')
    root = tree.getroot()
    for s in root:
        for ss in s:
            fio = ""
            for sss in ss:
                fio += str(sss.text) + " "
            if wr_fio in fio:
                qwe = (s.attrib)
                return(qwe['NomerClassa'])
```

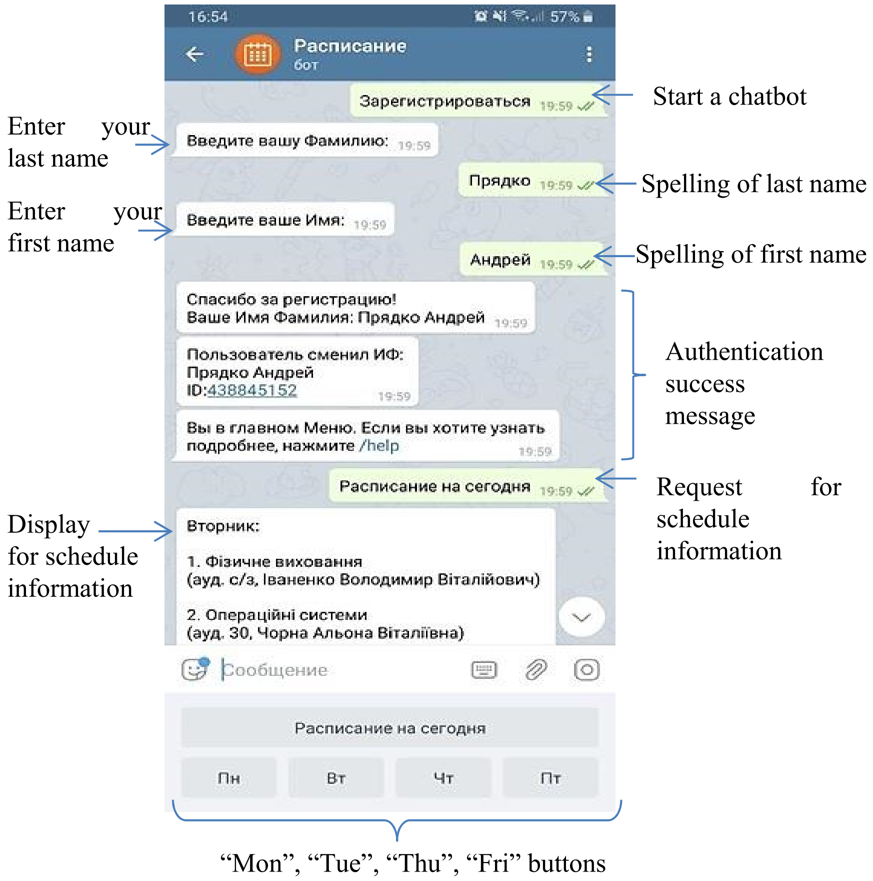
```
#find out what subject
def parser_predm(kod_predm):
  tree = ET.parse('xml/Predmet.xml')
  root = tree.getroot()
  for s in root:
    if s.attrib['kodPredm'] == kod_predm:
      return(s.text)

#find the name of the teacher
def fio_prep(kod_prep):
  fio_prepod = ""
  tree = ET.parse('xml/Prepod.xml')
  root = tree.getroot()
  for s in root:
    if int(s.attrib['KodPrep']) == int(kod_prep):
      for ss in s:
        fio_prepod += str(ss.text) + " "
  fio_prepod = fio_prepod[:-1]
  return(fio_prepod)

#find the student’s name and surname
#from the list in the database
def poisk_w_baze(chat_id):
    d = {}
    with open("baza.txt") as file:
        for line in file:
            d = line.split()
            if str(d[2]) == str(chat_id):
                return(str(d[0] + " " + d[1]))
```

Example structure of a xml-document with schedule information :

```
<?xml version="1.0" encoding="UTF-8"?>
<Raspisanie xsi:noNamespaceSchemaLocation="rasp.xsd"
xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance">
<Den DenNed="1">
<Class NumClassa="217-i">
<NumLesson NumLes="1">
<Predmet kodPredm="4">
<Prepod KodPrep="4">
<Kabinet>75</Kabinet>
</Prepod>
</Predmet>
</NumLesson>
<NumLesson NumLes="2">
<Predmet kodPredm="3">
```

```
<Prepod KodPrep="6">
<Kabinet>11</Kabinet>
</Prepod>
</Predmet>
</NumLesson>
```

The result of the chatbot in Telegram is shown in Fig. 2.



Зарегистрироваться 19:59

Введите вашу Фамилию: 19:59

Прядко 19:59

Введите ваше Имя: 19:59

Андрей 19:59

Спасибо за регистрацию!
Ваше Имя Фамилия: Прядко Андрей 19:59

Пользователь сменил ИФ:
Прядко Андрей
ID:438845152 19:59

Вы в главном Меню. Если вы хотите узнать подробнее, нажмите /help 19:59

Расписание на сегодня 19:59

Вторник:

1. Фізичне виховання
(ауд. с/з, Іваненко Володимир Віталійович)

2. Операційні системи
(ауд. 30, Чорна Альона Віталіївна)

Start a chatbot

Enter your last name

Spelling of last name

Enter your first name

Spelling of first name

Authentication success message

Request for schedule information

Display for schedule information

“Mon”, “Tue”, “Thu”, “Fri” buttons

Fig. 2. The result of the chatbot in Telegram

During the “communication” with the chatbot, the user has to enter his/her name and surname. By clicking on the “Schedule for Today” button, the user instructs to search the information according to the data and receives a response in the form of text describing the schedule for the current day. The “Mon”, “Tue”, “Thu”, “Fri” buttons can be used to get a schedule for these days.

7 Conclusions

In the research, it was determined that modern chatbot software in popular messengers on mobile phones can increase the efficiency in getting students information about the schedule. Reducing waste of time contributes to the efficiency of the educational process organization and the planning of students' educational activities. The chosen characters development tools for informing the student about the schedule (Python, XML, Telegram API) made it possible to quickly develop and launch the software tool in the student environment.

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