



Proceeding Paper

ArcheoBot Experimental Tools for Archaeology and Cultural Heritage †

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Abstract: ArcheoBot is a prototype of a Telegram Bot: it is an experimental prototype that builds on the common digital experiences of the authors of this article, aiming to offer a quick, powerful, easy to use tool. It aims to serve archaeological and topographical investigations quickly and to interface with other software for the management of collected data.

Keywords: ArcheoBot; Telegram; Telegram Bot; archaeology



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1. Introduction

Telegram is a cloud-based instant messaging and broadcasting service similar to WhatsApp, owned by Facebook; it is provided on a non-profit basis by Telegram LLC, a Dubai-based limited liability company founded by Russian entrepreneur Pavel Durov. The official service is distributed as free software for use in Android, Linux, iOS, MacOS, and Windows; this allows great flexibility in the management of functions, even allowing for customizations or the development of solutions that integrate the program's functions: an example in this sense is that it is made up of bots, systems capable of carrying out actions or managing data automatically. Telegram allows you to sequence your bot through a series of commands capable of interacting with the app's native tools: the widespread use of the program is an absolute advantage compared to the specific and customized compilation of ad hoc applications.

It is therefore possible to use the potential offered by the Telegram (<https://core.telegram.org/> (accessed on 30 May 2021)) API to develop tools to support specific activities, including, as in the present case, archaeological reconnaissance and the registration of individual stratigraphic units, in a guided and rapid way, able to interface with repositories and other standalone programs [1,2], via the web.

Today, the development of Telegram Bot for application in the field of cultural heritage seems to be (<http://www.saveriog.net/Bot-telegram-del-bullettino-della-commissione-archeologica-roma/> (accessed on 30 May 2021)) solely linked to applications developed by Saverio Giulio Malatesta: DBCAR (<https://www.saveriog.net/atlas-Bot/>, accessed on 30 May 2021), Fasti Romani (<http://www.saveriog.net/Bot-telegram-fasti-romani/>, accessed on 30 May 2021), and Ancient Atlas Bot (<https://www.saveriog.net/atlas-Bot/>, accessed on 30 May 2021).

Unlike the bots listed above, ArcheoBot can be used to enter consequential information in a structured database ready for the archaeologist to use.

These activities, whether they are emergency excavations or reconnaissance work, require the speed and punctuality of annotation and documentation and the ability to store information that can then be easily reworked at a later time.

Initializing ArcheoBot is very simple: if it has not already been done previously, you must download and install Telegram on your smartphone (it is available for both Android

and IOS), search among the available chats, and find ArcheoBot, verbatim. Enter the chat channel and you are ready to start collecting your data.

The main ArcheoBot commands will then be presented, providing two simple and fast workflows in the field for the construction of one's own work database in ArcheoBot. Finally, exports will be examined, and potentials will be analyzed explaining the complex problem linked to privacy to which the possibility of future developments is closely linked.

2. ArcheoBot Commands for Archaeological Reconnaissance

- 1.1. /start: by typing this command the Bot connects with our phone and enables us to enter a new site. In fact, the Bot replies:
- 1.2. "ArcheoBot, prototype for the insertion of expeditious archaeological information. Before use, carefully read the paragraph regarding privacy and use (you will also find guide and other information): <http://www.saveriog.net/ArcheoBot-telegram-per-larcheologia-e-il-patrimonio-culturale/#privacy>." (accessed on 30 May 2021).
- 1.3. At this point you can enter the first site of the survey by typing in chat: /site: allows the entry of information relating to a site, asking for its name, description and geographical coordinates (As long as you do not use the /us command or enter a new site by prefixing the name with the exclamation point, the last site entered will remain active; therefore, all the information entered or the US created will refer to it). By sending this message, the bot will reply: "Active site: Create a US card or enter the name of the new site in the format Name # Description."
- 1.4. So, you can answer, for example: "Colosseum", and by sending the message in chat, the Bot will reply asking for a description: "Site set on the Colosseum. Add description: " You can write in the chat: "Anfiteatro Flavio, the amphitheatre of Rome" and send it (the description can be as long as you like).
- 1.5. ArcheoBot replies: "Site description updated. Add GPS coordinates:" At this point, the Bot will ask you to enter the coordinates of the site. The addition of coordinates is possible directly through the Telegram application and the positioning system of your smartphone; or, if you are using the desktop version you must manually enter the coordinates using the WGS 84 (World Geodetic System 1984, EPSG: 4326, world geodetic geographic coordinate system, based on the reference ellipsoid developed in 1984) system in round brackets divided by commas, for example, (41.89025465582607, 12.492397641231898).
- 1.6. At this point, in the event that the work is topographical, with the insertion of toponyms, descriptions and coordinates, it will be possible to move to a second site and repeat the same choices by communicating with the Bot. Once the survey has finished or returned to the field to view the recorded data, you will have to type: /jobs. ArcheoBot responds to this command by sending the list of all the sites stored via Bot, in chronological order of insertion, with indication of the site name, coordinates and description.

This list can be copied and pasted on a spreadsheet, or exported directly from the web counterpart, where by accessing with an automatically generated code, you can download a .csv file, very useful for analysis and cartography, using QGIS (using the "insert layer of delimited text") [3].

3. ArcheoBot Commands for Archaeological Excavation

As for archaeological excavation activities, ArcheoBot is configured as a useful tool to manage its stratigraphy, it can be used as a register of US records on emergency excavations and as a substitute for US ministerial records in different places and occasions in the case of impromptu discovery or scientific excavations. The Bot was tested by Paolo Rosati in the excavations of the 'Episcopio di Portus' and the Etruscan Tombs of 'Bomarzo' Necropolis of 'Trocchi', an area without telephone coverage.

Once the site has been saved, for example, the "Anfiteatro Flavio" in Rome (the so-called Coliseum) with its coordinates (supra 1.5), to insert a new US, just type the command,

- 2.1. /us: this allows the expeditious insertion of information about the stratigraphic unit of interest; the number, the type (e.g., cut), a quick description, the stratigraphic relationships are asked (in order: covers, covered by, cuts, cut from, fills, filled from, leans on, leans on, is ties to, equal to), a photograph (functionality under development), a possible audio file for voice notes (functionality under development), and finally, the geographical coordinates. As long as you do not use the command / site or enter a new card by prefixing the number with the exclamation point, the last site entered will remain active; therefore, all the US entered will refer to this item. ArcheoBot's response will be: "No US card inserted. Create a new one by prepending! to the name".
- 2.2. Then, typing, for example: "! 1" The Bot will reply: "US entered: 1. Add type:" We will then write, by way of example: "Filling".
- 2.3. ArcheoBot: "US1 type updated. Description:" The archaeologist will type, for example: "US 1 is a yellow clay matrix filling of the US 3 pit, with a slope from East to West, measuring 3 × 6 m and facing North" and send the message.
- 2.4. To insert a stratigraphic report, ArcheoBot: "US1 description updated. Stratigraphic reports—covers US (0 if null):". Archaeologist: "Fills US 3"
- 2.5. At this point, ArcheoBot gives us the possibility to insert other stratigraphic reports; in fact, ArcheoBot replies: "US1 covers US fills us 3. Stratigraphic reports—covered by US (0 if null):". If there are no further reports to be entered, a new US can be entered by starting over.
- 2.6. At the end of the day or to check the data entered, we can use the following command: /register, which displays the list of all UUSSs stored via Bot, in chronological order of insertion, with an indication of the site and type.

ArcheoBot: "UUSS entered by you: 1 (*Anfiteatro Flavio Roma*), filling: US 1 is a yellow clayey matrix filling of the US 3 pit, with slope from East to West, measures 3 × 6 m and is oriented to the north".

4. ArcheoBot and QGIS

ArcheoBot now allows you to store sites and UUSSs with stratigraphic and detailed information, with the possibility of adding the coordinates; this allows you to work with QGIS or with any other data storage program. For ease of use and dissemination of the program, it was decided that a possible workflow through QGIS would be indicated in order to then work with pyArchInit (the usual operation by the writer) [4,5].

A great novelty compared to other Bots previously developed is the ability to view and download information entered in the form of a list directly from the web counterpart. Continuing the excavation data entry exercise, by typing the command:

- 3.1. /consult, you get the following message in chat, "Copy the following code: (an 11-digit code appears in this space) and paste it into the login box on the web page (a 4-character alphabetical code appears here)/. N.B.: the strictly personal code is valid for one hour. " In this way, working on the ArcheoBot surveys, you can download the register of archaeological sites directly from your PC, organizing your data as you wish. With data containing punctual coordinates, it is advisable to organize the worksheet in CSV format and then work on it with QGIS (insert delimited text layer). For now, this must be performed personally, but soon it will be possible to download the data directly in CSV format. By copying the list of sites entered with their coordinates, you can proceed with data processing.

Similarly for the US register, once the list is reorganized into CSV format and entered into QGIS via a join, it can be connected to the increasingly powerful pyArchInit (<https://github.com/pyarchinit/pyarchinit> (accessed on 30 May 2021)), with which excavation plans can be easily processed, complete the UUSS cards in ministerial format and check the progress of the investigation by exporting the Harris matrix.

This is what ArcheoBot allows you to do today, simply using a smartphone, tablet or PC in order to guarantee search agility and data processing speed. Any computer can be used with QGIS to achieve complex visualizations and elaborations and to better organize your data.

5. Privacy

A problem that we encountered during the development of the Bot concerns the privacy of data and users. In order to correctly store data, it is necessary to register the user and the choices they make; this is achieved using a unique ID to which each Telegram user is associated and is further encrypted by a specific function of the PHP code.

In the statistics of use of the Bot by users, the code that identifies the user who is using the Bot is linked to the commands /site and /us and is separated from their ID in the Bot, which is only linked to the time and day of use; therefore, it is absolutely anonymous.

Therefore, user's name, surname, telephone number or other information is stored; only a numeric ID, encrypted, associated with the site and US information, is retained.

Being a Bot used by a user and intended to send information to oneself, currently, this Bot does not interact with groups. The information sent is in any case encrypted; therefore, even if information is stored on the Telegram server, it is already encrypted in itself (<https://telegram.org/faq/it#d-quindi-come-crittografate-i-dati>, accessed on 21 July 2021)—so the conversation with the Bot can be consulted from your smartphone, from a computer via Telegram Web (<https://web.telegram.org/>, accessed on 21 July 2021), a desktop (<https://desktop.telegram.org/>, accessed on 21 July 2021) or from any device in which it is possible install the app and log in with your credentials—in an unstructured form (as if it were a normal chat).

The information is instead structured on the server where the Bot was installed, but as it is encrypted before it is sent, it is not readable by the developer.

However, they remain stored on the Telegram server (<https://telegram.org/privacy>, accessed on 21 July 2021), for which the regulations set out in the code of conduct apply, which make this messaging program unique in the reference landscape (<https://telegram.org/faq/it#d-qual-il-vostro-pensiero-riguardo-la-privacy-su-internet> and <https://telegram.org/faq/it#d-per-quello-che-riguarda-il-gdpr>, accessed on 21 July 2021). From the server on which the Bot relies, you can completely delete information at any time, via the management portal or the command/delete everything—features that are under development. Being encrypted, it is therefore impossible to trace who wrote what.

Given the potential offered by the Telegram API, the possibilities for expanding the tool are vast; in particular, in the future, the possibility of saving photographs and audio notes will be included. Some processes are being studied to enable this data to be treated as simple text strings, and then encrypted like all other data.

The only sensitive information currently detected is the position; when the coordinates about the site, UUSS or site are added, the position is not sent automatically, but a request appears to the user by pressing a specific button exactly when you send your position to other users via the chat. The coordinates sent, being alphanumeric (in decimal format, e.g., 41.89025, 12.49273 -> <https://www.openstreetmap.org/query?map=18/41.89025/12.49273>, accessed on 21 July 2021), are encrypted exactly like the others.

Obviously, since everything is linked to the Telegram ID processed with reference to a phone number (<https://telegram.org/faq/it#il-tuo-numero-di-telefono-nascosto>, accessed on 21 July 2021), giving your smartphone to another person or using a shared device (for example a tablet used by several individuals), provides others with accessibility to data stored using the profile on the device itself. In the case of multiple use, good practice is to write the name of the compiler within the 'Description' item, so that the working group is clear about who enters what.

The use of the Bot implies the knowledge and acceptance of the user regarding the aforementioned conditions and methods of use, in view of a software prototype as it is, without any guarantee, for which any responsibility is declined.

6. Advantages and Next Developments

In addition to the normal, useful scenario of use in which the Bot is used in an area with a telephone or WIFI connection, the main advantage of this kind of system is linked

to the fact that the Bot works perfectly in the presence or absence of an internet connection, or a stable telephone connection.

In the event that stratigraphic research is carried out in an area with no connection, it is advisable to manually enter the coordinates of the site where digging will take place using a PC connected to an internet line before the start of the mission (you can always choose not to enter them for the moment).

In fact, in the field, it is possible to enter excavation data without the need to worry about online registration. At the first opportunity to connect to a data connection line, ArcheoBot will send the entire working day directly to the storage.

This allows the use of ArcheoBot in excavation areas and in usual working conditions for the archaeologist in an ecumenical, desert, wooded, agricultural, mountain, building, underground or underwater areas.

With this first release of the Bot, therefore, a smart and multitasking tool is already available to record data anyway, even in the absence of an internet connection, it is indeed in the most isolated conditions that the Bot acquires its own unique utility.

Furthermore, the battery consumption is very limited; when using the device exclusively and only having to send text messages in a chat, any Android and IOS smartphones and tablets, or Mac, Windows and Linux PCs can work for days.

In working conditions in isolated areas, where the Bot displays its advantages, if the device is connected to a power bank its range is even longer, and if you have solar panels available in the field to charge the batteries, the problem is solved. The device also solves the possibility of finding oneself without a data recording device.

The data resists absolute utility; being recorded in the cloud, the possibility of loss is only associated with the destruction of the central Telegram server. Everything will always remain associated with your Telegram account and therefore will always be recoverable, even in the case of the breakage or loss of the smartphone, tablet or PC.

The development of the technology is structured around the different possibilities that Telegram and PHP offer operating on the server side. At the date of the last update, these were the expected developments:

- Connection to the pyArchInit database server for direct viewing in QGIS;
- Creation of a webGIS relating to their input data, together with the possibility of downloading them in .csv;
- Creation of site/UUSS cards in .odt/.pdf format to be sent by email;
- Creation of the management portal of the information entered via Bot relating to your Telegram ID;
- Command/delete all to delete your entries from the Bot server (after saving them locally, hopefully!);
- Command/note for quick entry in the case of reconnaissance work;
- Command/signal to enter or send notifications about emergency situations relating to cultural heritage.

The Bot will also be implementable based on further and continuous developments released by the app development team.

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