A mobile gnomonic tool for Android devices[1]

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A software tool is here presented, in the form of an "app" for Android devices, that makes available in a convenient and portable format all the astronomical data required for designing and/or verifying a sundial. Moreover the possibility of sundial simulation, together with the availability of position and orientation sensors, suggests to use this app for educational purposes.

Introduction

A large part of the dialists in the world have probably used in the past, and maybe are still using today, the Dialist's Companion [ref. 1] DOS program to find the sun parameter values that are needed for sundial design or verification. Although this program can still be used today (by means of suitable DOS emulators) as well as many other freeware computer programs (for example Orologi Solari [2]) it must be noted that new portable computing devices called smartphones and tablets, commonly used today, can offer a greater flexibility allowing to easily get the required values exactly where they are needed i.e. near the wall or the sundial to be designed or verified.

Sol Et Umbra (SEU) is a freeware app for Android devices that shows a similar set of information as Dialist's Companion. Additionally it takes advantage of the sensors that are available in Android devices (GPS receiver, magnetic sensors, accelerometers) to provide supplementary features.

SEU can be downloaded to the device through the Google Play Store app.

Sun ephemeris page

SEU starts showing the page in fig. 1.
All parameters are computed [ref. 3] for the time as shown by the device. However since smartphones can have a large clock error, SEU makes use (when authorized by the user) of the internet connection to get the exact time from an atomic clocks network through the NTP protocol. As a result the indicated time is correct within 1 second.

Following data are contained in a vertical scrollable area.
First of all the local coordinates, as obtained from GPS or from the network, are shown. Then there is a list of time and sun parameters that cover everything a dialist could need. Finally the last lines contain the Islamic prayers times for the current date.

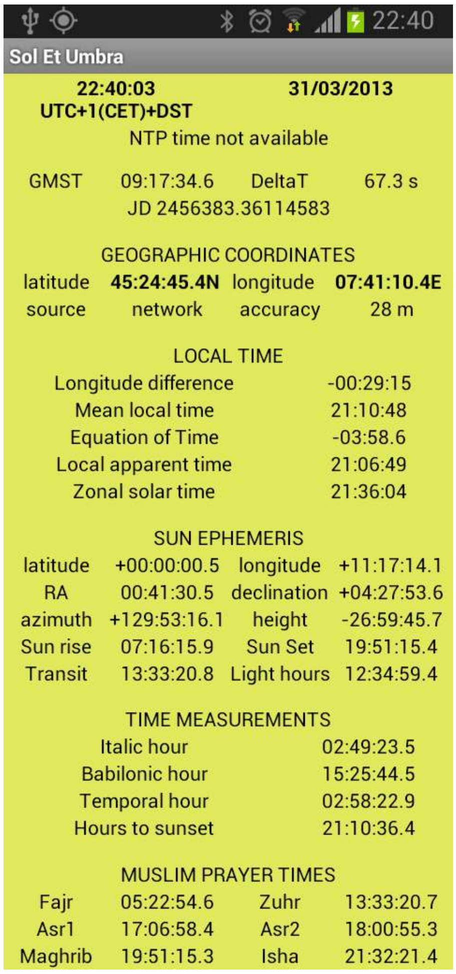

Fig. 1 – Sun ephemeris page

[1] This paper has been originally presented at the XVIII Gnomonic Italian Seminar, Chatillon (Ao), Italy, October 2012

A click on the time/date line activates graphic commands at the bottom of the display that can be used to change time and date, while all the sun parameters are still displayed in real time (fig. 2). As an alternative a menu command is available to change time and date via a suitable dialog.

Fig. 2 – Time change controls

The location position can be changed through a dialog too, however a map can also be activated to set the desired location. A *find place* command is also available to easily find the coordinates of whichever place in the world and to obtain sun ephemeris for that place.

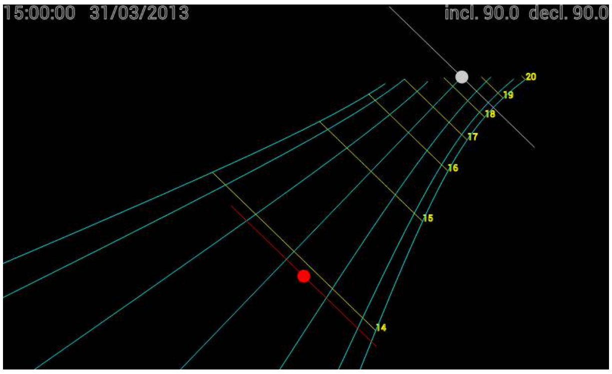

Fig. 3 – Sundial simulation

Sundial simulation

Android devices usually contain magnetic sensors and accelerometers that can provide the orientation of the device in space[2], therefore an Android app can compute the declination and the inclination of the plane containing the device display.

SEU can so draw a sundial on the display and it can update the drawing as the device is moved (fig. 3). Options are available to draw different types of hour lines and to draw the shadow of the style. Moreover a command is available to stop the automatic update and to fix the declination / inclination couple to the desired values.

An additional graph can be drawn showing the sun paths on an azimuth/elevation diagram for the local place (fig. 4). Depending on the set of declination and inclination values, sun paths and line hours are colored such that the time periods when the dial is lighted can be identified.

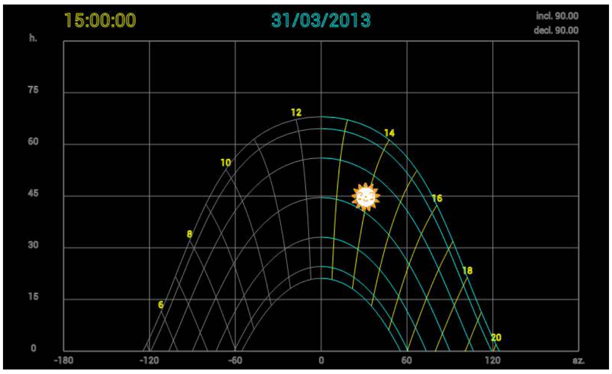

Fig. 4 – Lighting conditions graph

The main purpose of the sundial simulation feature is to provide an educational tool for learning sundial dependency on wall orientation.
Although this feature could be theoretically used to actually design a sundial by just laying the device on a wall, this cannot be practically done (at least today) because of the large errors magnetic sensors can sometimes exhibit.

References

[1] R. Terwilliger & F. Sawyer , “The Dialist’s Companion”, 1996
[2] G. Casalegno, “Orologi Solari”, http://digilander.libero.it/orologi.solari/download/download_enu.html
[3] J. Meeus, “Astronomical Algorithms”, Willmann-Bell Inc, Second Edition 1998

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[2] Magnetic sensors can easily get uncalibrated. See SolEtUmbra help pages for a calibration procedure.