

Google Sky Map: Using your Phone as an Interface

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ABSTRACT

Google Sky Map, an application for Android mobile phones, allows the user to discover and browse the sky by simply pointing the phone to space. Using the Android phone's orientation sensors, Sky Map shows a particular stellar map specific for each user's location. This paper describes the design principle used for Sky Map: the use of the mobile device as the main interface and the GUI as a secondary guidance. The GUI in Google Sky Map is kept as minimal as possible. The search GUI is an example of how an on-screen GUI and the physical movement of the phone can work in harmony to provide an accurate user experience. Google Sky Map was developed by five Google Engineers and one User Experience Designer.

Categories and Subject Descriptors

H.5.2 [User Interfaces - D.2.2, H.1.2, I.3.6]: Graphical user interfaces (GUI) . User-centered design, Interaction styles.

General Terms

Design, Experimentation, Human Factors, Standardization.

Keywords

GUI, mobile, sensors, space, planetarium, interaction style.

1. INTRODUCTION

Google Sky Map was first launched to the Android market on May 12th, 2009. Google Sky Map uses the Android phone orientation sensors (digital compass and accelerometer) to display a star map specific for each user's location, established by one or more of the following methods:

- Network: location established via the telephone network,
- GPS: location established via GPS coordinates (requires the GPS function to be enabled), or
- Manually.

Google Sky Map requires no connectivity in order to function. This was a main design constraint since we wanted the application to be especially valuable for users on remote locations and situations (i.e. in the mountains, in a cruise), and to enhance star gazing where it can be done best through naked eyes.

Several tools that aid star gazing have been developed through time, such as telescopes, star charts, personal planetariums (SkyScout Personal Planetarium) computer desktop applications (Google Sky, The Sky Six Professional edition, etc), and even mobile phone applications (Star Walk, Pocket Universe, etc).

The novelty of Google Sky Map is the way in which the user interacts with the application. Using the phone as the main

interface, we provide easy and intuitive means for the user to discover the space. By simply superimposing the phone against the sky, our users can discover instantly the name and shapes of stars, constellations, planets and Messier objects. The second user case supported by the application –but as equally important– is to let our users search for specific celestial objects in the sky.

Google Sky Map is not an augmented reality application (an app that uses the device camera and overlays information on top of it). We calculate, in real time, the position of the celestial objects utilizing the user's date, time, location, phone's angle (how the phone is held) and the speed in which the user is moving the device. Once we have all these variables, we are able to render the sky.

Google Sky Map is available for free to any Android powered phone via the Android Market. It is located within the reference section. The user needs to download the application, save it to their mobile phone and lastly install it.

2. USER INTERFACE

The GUI shows a virtual representation of the sky to our users. The GUI has the following display elements: background color (showing either day or night), grid, planets, stars, constellations, Messier objects, and the horizon. **Fig [2].**

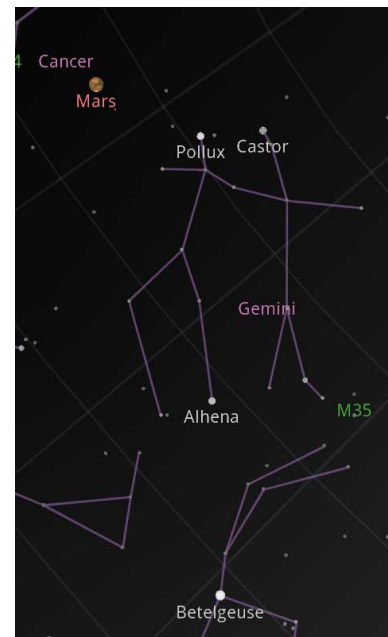


Fig 2. Main GUI.

2.1 Control panel

The main GUI does not show any controls until the user taps on the screen. We want to provide a clean and simple user experience by maintaining the GUI as uncluttered as possible. Once the user taps on the screen, the control panel will show up. **Fig [3].**

The control panel consists of three main sections: layers, zoom, and navigation mode.

The layers section controls which layers are visible to the user at a given time. The layers' buttons follow a toggle behavior. If the user taps them, they will switch from an off to on state and vice versa. There is a visual feedback that will change the icon color. The layers that we support are:

- Stars
- Constellations
- Messier objects
- Planets
- Grid
- Horizon

The zoom section allows the user to zoom in and out when tapping on these buttons. The navigation mode section allows the user to select either automatic or manual mode. In automatic mode, the user utilizes the phone to navigate, the virtual sky changes along the location and inclination of the phone. On the other hand, in manual mode, the user needs to tap and drag the sky in order to navigate.

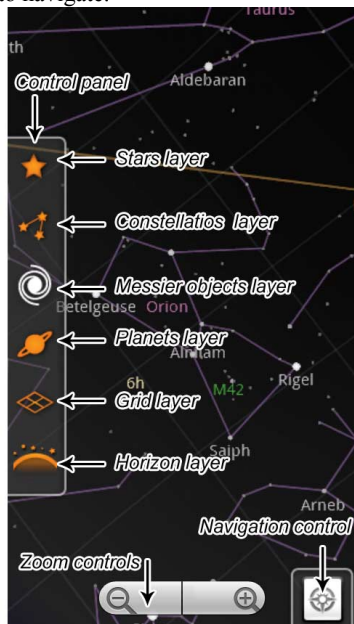


Fig 3. Control panel GUI.

2.2 Menu

Google Sky Map contains more options under a standard Android menu. To access these, the user needs to press the “menu” button of the Android phone. The following options are available:

- Search: the user can search the night sky using the device as an interface
- Toggle night mode: the GUI turns red in order to provide a better experience during nighttime. By turning the GUI red, the

brightness diminishes and makes the sky viewing more comfortable for the user. This is a standard behavior in astronomical applications.

- Settings: users can access the layers through a standard Android icon, as well as change the way in which the application gathers their location.

- Gallery: the Hubble images gallery.

- About: contains information about the data sets used and about the authors **Fig[4].**



Fig [4]. Menu

2.3 Search

Search within Google Sky Map functions with the same principle as the main GUI. In order to search, the user needs to press the search button on the Android powered phone, or press the Menu key and then select search.

Once the search mode appears, the user can start typing the desired object's name (using a physical or the on-screen keyboard) **Fig [5].** The search text-box contains suggestions for the most common celestial objects like planets, stars, Messier objects, and constellations.

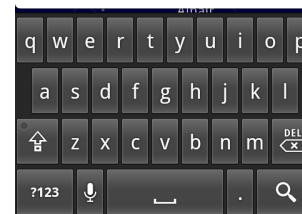
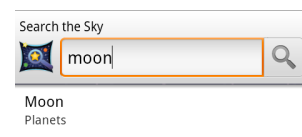


Fig 5. Searching for the “moon” inside Google Sky Map.

After the user executes the query, the application will enter “search mode”. During this mode, the GUI will change into a circle with an arrow outside of it, which is displayed in the middle of the screen. This arrow will point towards the desired object. The user will need to physically follow the arrow with the phone to “find” the desired object. As the user gets closer to the target, the circle will change its color from a range of cool tones to a warm palette. When the user “finds” the target, the circle will grow and change color to orange, while the text label will change to “you found” plus the name of the target **Fig [6]**.

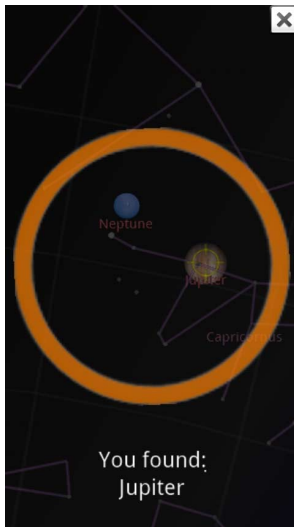


Fig 6. Finding Jupiter

2.4 Gallery with search in the sky

Due to the 20th anniversary of the Hubble Telescope, we incorporated a set of images that show certain celestial objects in great detail. Using the same paradigm as search, our users can seek out the location of these objects by pressing the “Find in sky” button. **Fig [7] Fig [8]**.

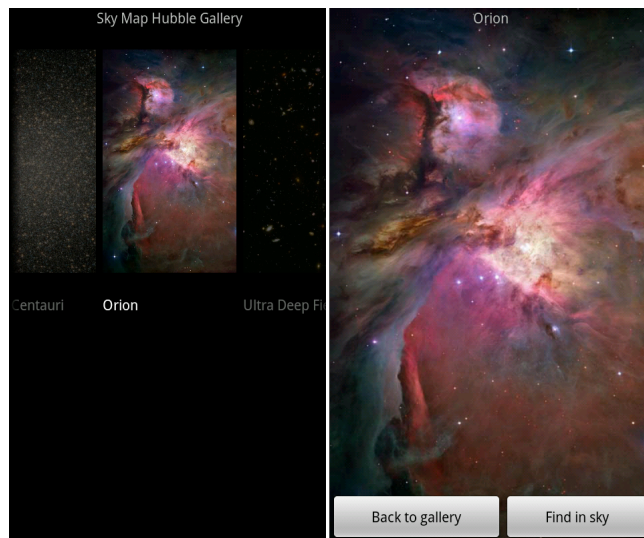


Fig 7. Gallery

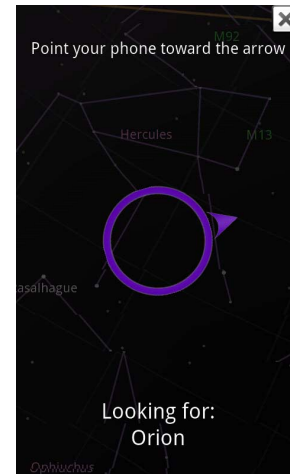


Fig 8. Looking for Orion from the gallery

3. CONCLUSION

Google Sky Map is designed for amateur astronomers and people that inquiry about the sky. Its goal is not to be the most precise portable planetarium, but to inspire curious individuals through a very intuitive interface. The two main identified use cases -tell me what is that object and help me find an object- were inspired from the same design principle: use the mobile phone as the main interface and the GUI as a secondary guidance. By applying today’s modern technology incorporated in Android devices, we are able to provide a simple interaction that otherwise would require a greater knowledge of astronomy or many data inputs from the user. Google Sky Map brings niche knowledge to the everyday user.

4. ACKNOWLEDGMENTS

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