Where am I?

Age-group: 9-12 years' old
Number of hours: 3,5 hours
Short description of activity: In this project students will be introduced to Earth as a huge magnet and how the compass works which can help us not to be lost. What is location and what a global address consists of. Students will know how to create two different types of compass (one homemade, other mobile app).
CT-competences:
- Algorithms (Analysis & Design),
- Programming, testing & debugging,
- Simulation,
- Abstraction,
- Decomposition.

Goals

- Introduce Earth as a huge magnet, what is magnetism?
- How works compass which can help us not to be lost.
- How to create two different examples of compasses (one homemade, other mobile app).
- What is location and what a global address consists of.
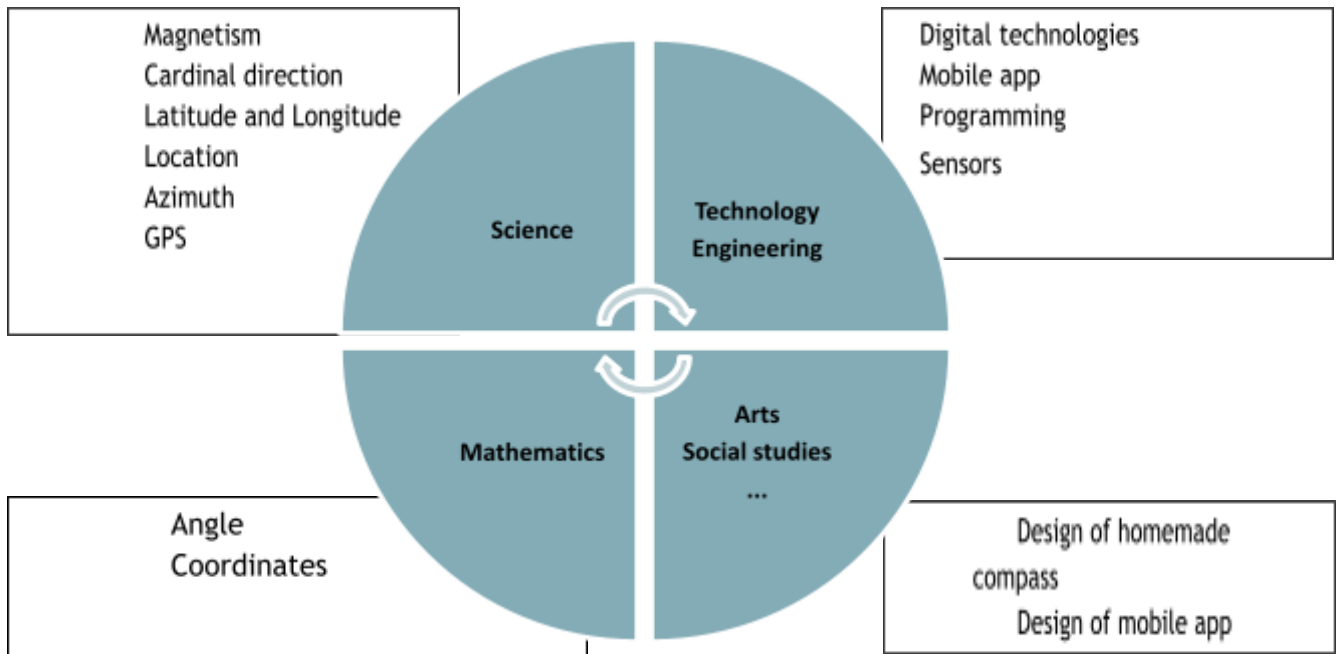
Realistic STEAM-context

To orientate means to know where you are (so, not be lost). A lot of children have smart watches or other wearables and do not understand how their parents know about the place where they are. For adults it is not surprising that GPS is used for that all-important location tracking.

On the other hand, our children spend a lot of time using technologies, but they also read books about anxiety and pirates. The question arises as to how people oriented in those times.

For this reason, students should know what a compass is and how it can help us.In this project we are proposing to make two different compasses (homemade and mobile app) in order to know where we are. These days, making a mobile app with compass properties doesn't need to be difficult.

(short justification of STEAM-integration)

Methodology

Part	Description	Timing
1	**What is a compass?** A **compass** is an instrument used for navigation and orientation that shows direction relative to the geographic **cardinal directions** (or points). A compass works because Earth is a huge magnet. A magnet has two main centers of force, called **poles**—one at each end. Lines of magnetic force connect these poles. Earth's magnetic poles are not the same as the geographic North and South poles. The geographic poles are located at the very top and bottom of a globe. The magnetic poles are nearby but not at exactly the same places. A compass points to the magnetic North Pole, not the geographic North Pole. Depending on where the compass is located on the surface of the Earth the angle between true north and magnetic north, called magnetic declination can vary widely with geographic location. ● Teachers should introduce that Earth is like a magnet and what magnetism is. Why does the compass work and why do we need such a device for orientation. https://www.youtube.com/watch?v=MqCiY7MAT2U (1:30 min. about magnetism and compass) or https://www.youtube.com/watch?v=OsQNHFlF8w4 (3:40 min. about magnetism and compass) or	120'

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	https://www.youtube.com/watch?v=yXCeuSiTOug (3 min. about magnetism and compass) ● Teacher introduces how compass uses the geographic cardinal directions (or points); https://www.youtube.com/watch?v=yOv_6yyuJJg (2 min. about Cardinal Directions); https://www.pbslearningmedia.org/resource/activity-starter-intermediate-directions/activity-starter-intermediate-directions/ (2 min. Intermedia Directions) ● Teachers can present the history of the compass. More information about compass (https://facts.kiddle.co/Compass) **Practical part of this lesson** – students will construct homemade compasses. https://www.youtube.com/watch?v=Dm91NGofFxU (4 min. How to create Homemade compass) or https://www.youtube.com/watch?v=4_tQQFHpSa4 (3:20 min. How to create Homemade compass). ● Discussion about this practical activity. What is the result of such a compass?	
2	**Programming app of compass** Every location on Earth has a **global address**. Because the address is in numbers, people can communicate about location no matter what language they might speak. A global address is given as two numbers called coordinates. The two numbers are a location's **latitude number** and its **longitude number**. In this lesson students will create apps with compass properties. This app will show a student's location. ● Students will be introduced to global addresses (the two numbers are a location's latitude number and its longitude number); https://www.youtube.com/watch?v=-8gg98ws2Eo (2:30 min. about Longitude and latitude) ● What is **GPS** and how does it work? https://www.youtube.com/watch?v=RSA3feQ9gKk (2:30 min. How does GPS work?) ● Students should have understanding that compasses need azimuths data. **Azimuth** is the angle between the north/south line, and an imaginary line between you and an object/location you are headed for. More explanation: https://study.com/academy/lesson/azimuth-definition-lesson-for-kids.html ● The students will be introduced to programming and app development with App Inventor (for Android): https://appinventor.mit.edu/	90'

- App Inventor have a list of sensors (a device that detects, or senses, a signal.). What is sensors: https://facts.kiddle.co/Sensor

- In this task of compass design and programming, students should use two sensors: Orientation Sensor and Location Sensor. Orientation Sensor (An orientation sensor is a non-visible component that reports the following three values, in degrees: Roll, Pitch, Azimuth). http://ai2.appinventor.mit.edu/reference/components/sensors.html#LocationSensor Location Sensor (component providing location information, including Latitude, Longitude, Altitude (if supported by the device), speed (if supported by the device), and address. This can also perform "geocoding", converting a given address (not necessarily the current one) to a latitude (with the LatitudeFromAddress method) and a longitude (with the LongitudeFromAddress method). http://ai2.appinventor.mit.edu/reference/components/sensors.html#OrientationSensor

- Realization of compass app with App Inventor. Video tutorial how to create very similar compass app on App Inventor: https://www.youtube.com/watch?v=9HoIorx7hX0

Students should log in to App Inventor (https://appinventor.mit.edu/) and to "Start new project", name it and start activity in "Designer" mode.
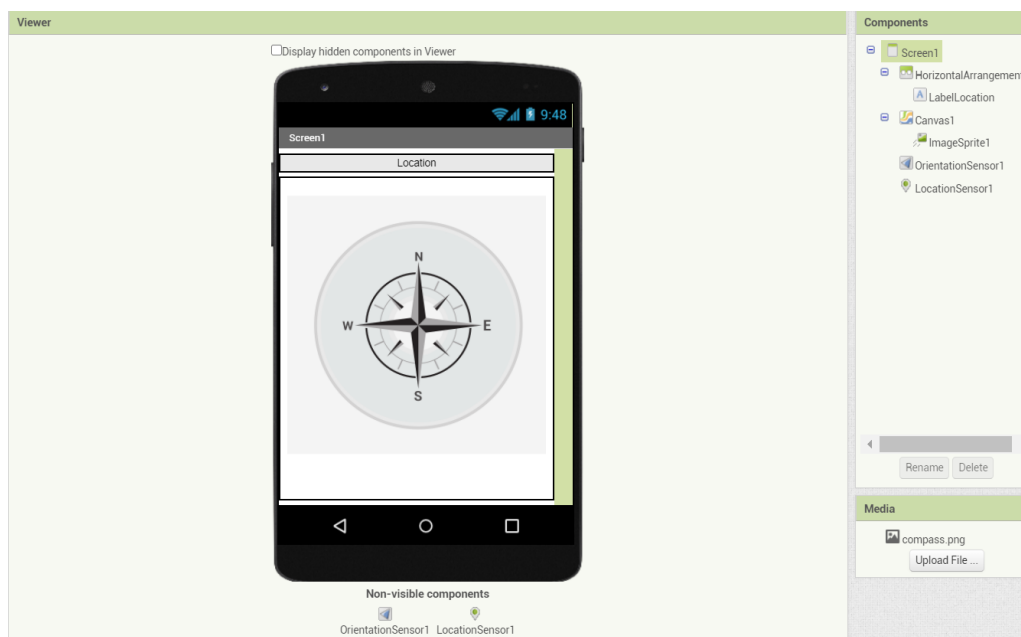

Students can be more creative and design the layout of app's components by themself. Choose different colors, fonts and etc. Also students can paint another picture for the compass.

To program compass actions in the app, students should change mode to "Blocks".
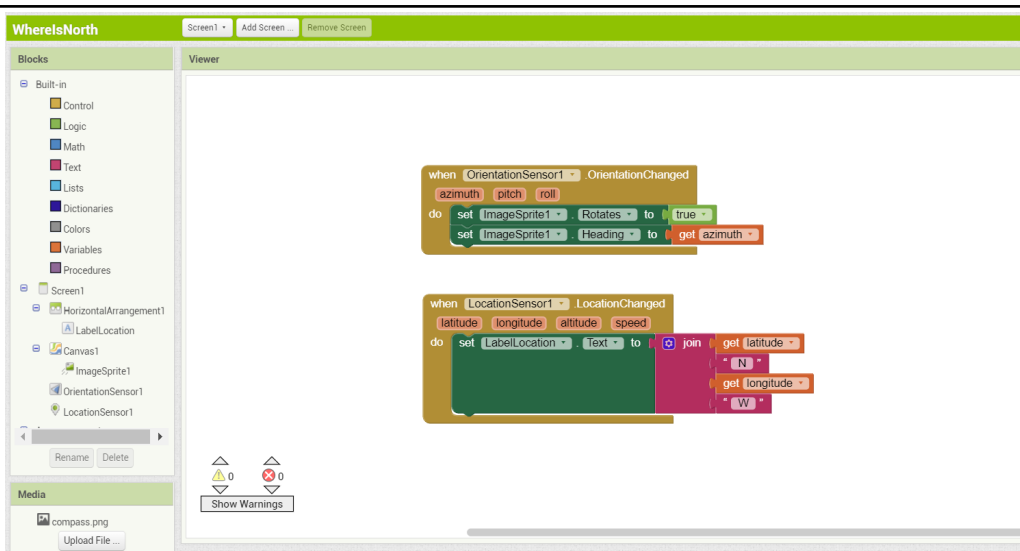
To know how the compass works, students should download the "AI Companion" app from Google Play to phone/tablet. And connect "AI Companion" via App Inventor.
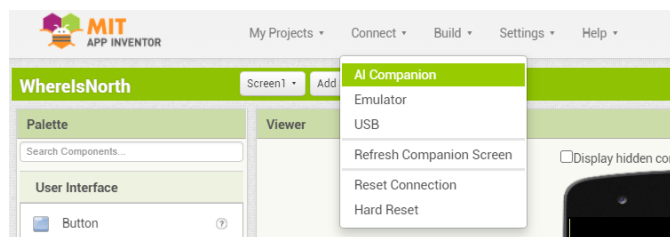
The result looks like this:

3,5 hours

Materials:
- Material for homemade compass.

Use of ICT:
- Smart phones, tablets, computers.
- App Inventor environment, "AI Companion" app.
- Internet

Coaching

Useful questions:
- Part 1 of methodology
    - What is magnet and magnetism?
    - What is a compass?
    - What are geographic cardinal directions?
    - How to construct a homemade compass?

- Part 2 of methodology
    - What is the global address, GPS, Azimuth?
    - What are sensors?
    - How to start working with an App Inventor?
    - How to design and program an App?
    - How to test an App?
    - How to find latitude and longitude with an App?

    Teamwork:
- Groups consist of 2-3 students.
- Competences needed in a group:
    - Collaboration
    - Communication
    - Trust
    - Responsibility
    - Problem solving
    - Management and organization

Formative assessment:
- Group work. Individual contribution to the work: the group gets a sheet of paper and they write what part of group work each of the students did.
- The completeness and correctness of the task are assessed by the test data presented by the teacher.
- Reflection. Students present greatest difficulties and ways to overcome the difficulties

Adaptations

- General ideas:
- Ideas with older children: (9-12 -> 12-15). By using App Inventor, students should design mobile apps for finding locations on the map.

Tips & tricks

(only mention when relevant, e.g. background information, …)

https://cnocoutdoors.com/blogs/blog/basic-navigation-with-a-map-and-compass

STEAM-CT