

USE CASE 05

Flashlight School Bag

Primary Actor and Main Goal

At school he acquired some basic programming skills already. Veikko also has a younger sister that just started school. Since they live a bit outside of Helsinki, both have to leave early in the morning to go to school. Especially in winter it is still dark when they leave home.

Topic and Content

Veikko has an innovative teacher who launches different projects. This month the teacher got some Arduino boards to launch different projects. He understood that with Arduino you can programme many different things and combined with sensors he can create many things with different functions.

Age & Level

Veikko, Finland
Student
12 years old

Description of Environment and Possible Pre-conditions

Veikko is a 12 years old student in Helsinki. He goes twice a week to swimming training, likes techno music but he is also fond of online games and computers. With the age of 10 he got for Christmas a Lego robot and with the help of his father – an engineer – he managed to get the robot going.

Veikko's teacher has asked them to build pairs and agree to a small project they would like to create. Veikko and his friend Pekka would like to do something of real usage that goes beyond playing or fun. Veikko and Pekka elaborate a plan to 'pimp' school bags: since they are leaving so early from home it is difficult for cars to see school kids in the dark, especially when there are no reflectors attached to the cool bags any longer (which leads often to discussions with his parents). Thus, Veikko and Pekka decide to build a sensor for the school bag that would start flashing on his school bag once the light becomes low.

Preparatory Work

The teacher asked them to prepare a sort of 'concept' that outlines the idea behind, the usage, the materials and skills as well as knowledge they will need a.s.o. Thus, Veikko and Pekka start to investigate which components they would need and establish the list materials, the sensors, the LEDs they would need, a.s.o. The boys also consider the different circumstances for the design (ie. snow and rain on the sensors and the Arduino board, ...). They hand over their written plan to the teacher and discuss with him the outline.

Description of Activity

Four days later, the teacher has ordered the needed Arduinos and each of the students have brought additional materials with them. Veikko has brought his old school bag for testing since he is not sure how to attach the LED lights, if he would need to make some holes in the bag, a.s.o.

The teacher helps him plan how to mount the LED lamps on the bag, and also reminds the students they need to insulate the component legs to avoid a short circuit. Before they start building, the teacher helps the students to test the photo sensor with one LED, as a 'proof of concept'. They search online for how to connect the components on the breadboard, and use an Arduino example sketch that reads analog values and maps them into the range suitable for LEDs. They learn about statements, and how to set a threshold for the lights to turn on. After the core concept has been prototyped, the teacher asks the woodwork teacher to help the students solder the parts together. The teacher has helped them draw a circuit on paper to aid them as they solder everything together.

Once everything is connected, it won't light up. The students are very disappointed, and are not sure what to do next. The teacher tries to cheer them up, and shows them a systematic approach to troubleshoot the error. They use the serial monitor to make sure they are getting values from the sensor, and that the threshold is properly set. After that, they upload a code to light up the LEDs only. They don't light up, and one of the students suddenly finds it's because they have not properly insulated the LED legs. Once the whole circuit has been properly insulated, all the technology is working as planned.

Other Stakeholders and their Possible Interests

As Veikko tells in the evening what he has done at school his sister also would like to have some flashing LED lights installed on her bag.

Veikkos realizes that the lights might need improvement in terms of design if used by smaller kids so that all the components are hold within one case. By creating this, the Arduino construction would be more stable than his initial installation and design. Thus, he designs a case in the 3D printing programme TinkerCAD.

His teacher allows Veikko to use the 3D printer at school to improve his project. During the creation of the case, there are a lot of errors to resolve at the beginning of the process to get the 3D model to print correctly. However, once in a while, the printing process fails, and Veikko has to discard the spoiled material and start the sequence again. Finally, Veikko managed to have the case printed and installs the Arduino in the case.

Success and Condition

One week later Veikko is allowed to take his LED lights home for his sister. Together with his mother, they only need to sew a Velcro stripe on the outside lunch box case of his sister schoolbag. Veikko connects the cable with the components in the case, turns off the lights and immediately the LED lights start blinking.

Variations

This type of scenario, where learners try to find the solution to a problem relevant to their everyday life has the power to engage them in a completely different way.