Sketching With Hardware - Pinball Wind Edition

Project description:
As the name of the project suggests, our project is a slightly different kind of classic pinball. Instead of the usual “flippers”, drone fans are used in this version - these are then used to control/steer the ball. To score points, the ball must activate infrared sensors that are installed at certain points on the field. If the ball falls, this is counted as a loss of points.

Planning:
First, we wanted to create a simple pinball field, which has a fan instead of the traditional mechanical shot putter. We wanted to check early on whether the existing motors with the rotor blades had enough wind power to bring the ball into the field.

Prototyping playing field:

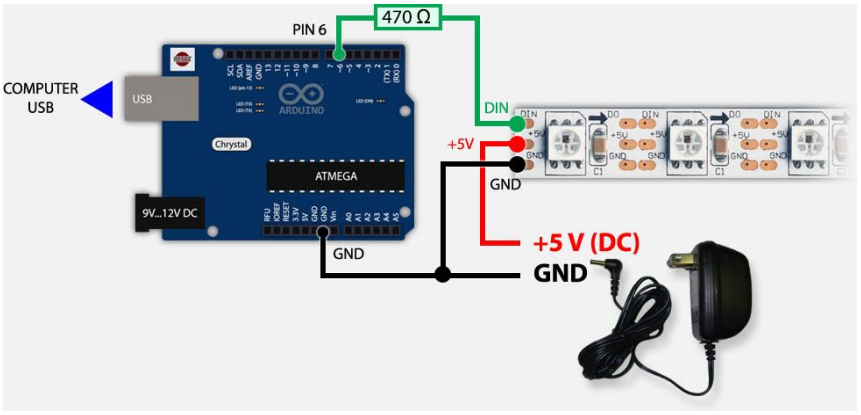
Code / hardware:

Hardware used:

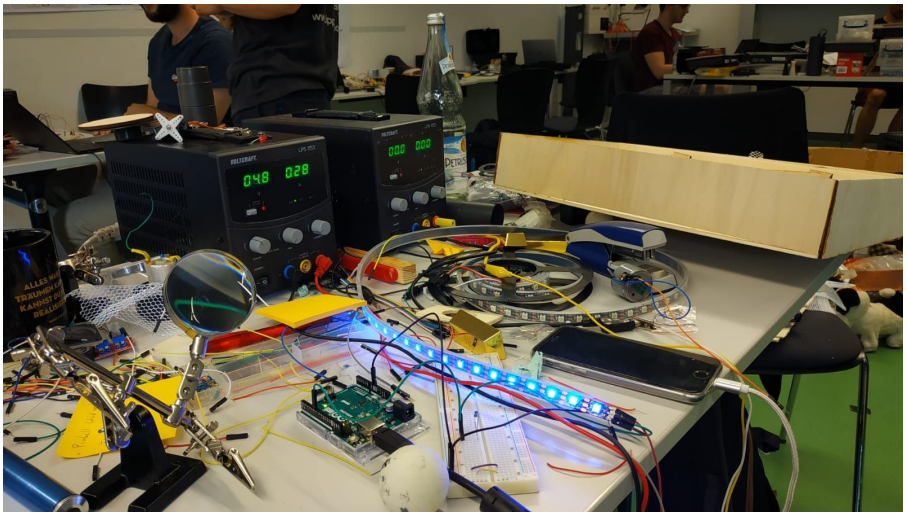
2 x Arduino Uno
5 x drone motor / fan
5 x switching
3 x IR sensor
2 x microphones
moduleWS2812B LEDs
motor

The second major part of the project was the programming and wiring of the individual sensors and actuators. We proceeded as follows: The first few days we programmed and tested the components individually - means drone motors, IR light barriers, microphones, LEDs, etc. There were actually no problems, individually it was quite easy to address the respective components and to program it as an "example".

LEDs: LEDs
We used to display the points. In this case LEDs of type WS2812, here each LED can be controlled individually. Following instructions from https://www.tweaking4all.com/hardware/arduino/arduino-ws2812-led/ , we have programmed the LEDs so that each time another point is won, another LED lights up green.

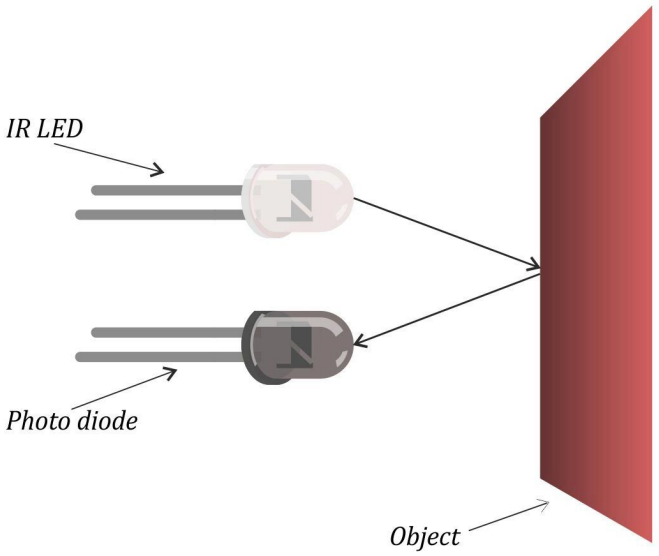


Wiring diagram of the WS2812 LEDs



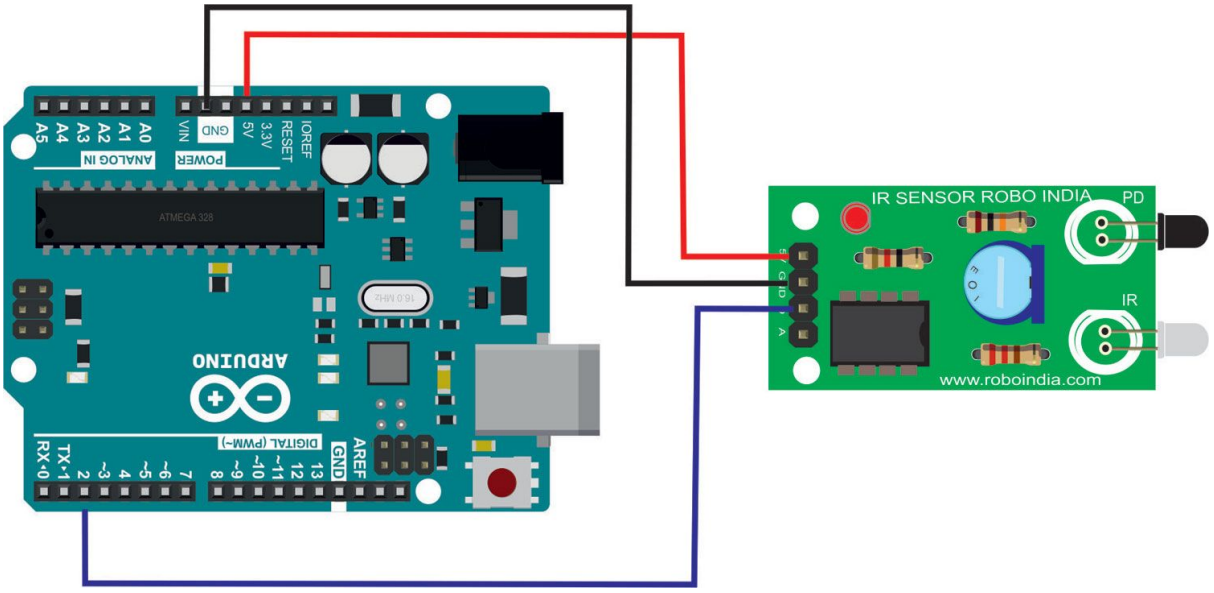
infrared modules:
In order to detect good/bad actions of the player (e.g. the ball falls to a difficult point → good action / the ball falls → bad action) and to implement a point system we have opted for infrared sensors decided. We have followed the following instructions:
https://roboindia.com/tutorials/digital-analog-ir-pair-arduino/

The functioning of the sensor should be understood as follows:



The LED emits infrared light. If the light is reflected (from an object, in our case the ball), it arrives at the diode and the sensor returns “True” to the Arduino.

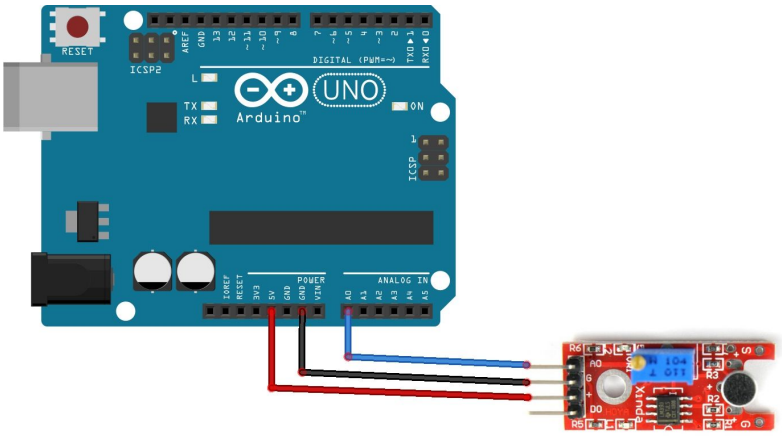
We connected the sensor as follows:



Microphone:

To activate the two upper fans, the player has to blow into microphones. This makes playing difficult and makes control a bit more diverse. In order to implement this, we have installed microphones on the right and left in front of the playing field, which continuously listens to the volume level in the loop (). As soon as the volume reaches a certain threshold (eg triggered by blowing), a PWM signal is sent to the respective drone motor and the motor is activated for a short time. We implemented the microphone according to the following instructions:

http://arduinolearning.com/code/ky038-microphone-module-and-arduino-example.php



It only became difficult when the components were integrated into the overall project and had to work together. Since the Arduino does not have an operating system, multithreading is not possible. As soon as (as in our case) several tasks have to be carried out at the same time (e.g. measure microphone level, IR light barrier status), a delay () leads to an interruption of the other tasks.
The elegant method would be to solve this problem with millis (), see https://learn.adafruit.com/multi-tasking-the-arduino-part-1 (very good tutorial). Unfortunately, since we only encountered this problem one day before the project was submitted, we simply solved it using a second Arduino. In our case, one takes over the control of the fans and the other takes care of the sensors.

Programming / implementation

Challenges:
What were the challenges in the development process?

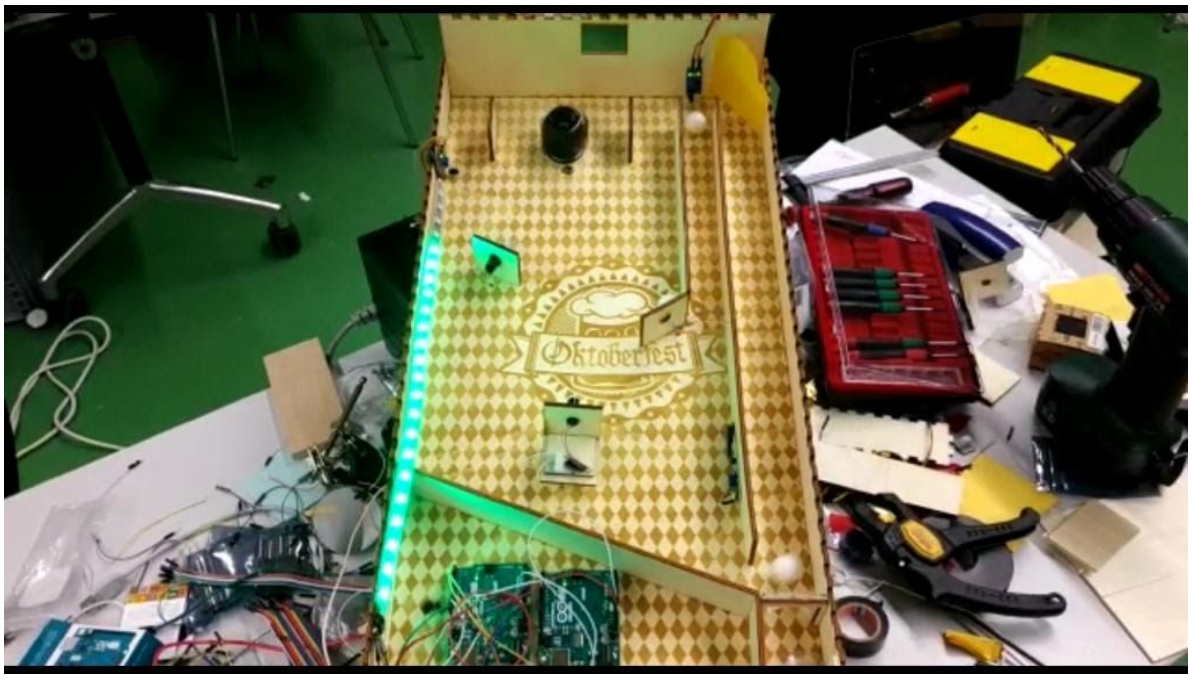
- **Game flow:**
  In order to guarantee smooth gameplay, we had to rebuild the first prototype and lower the propeller further. A net was attached to prevent the game ball from being thrown out by the propeller. Furthermore, the launch ramp had to be narrowed to increase the wind power there and to transport the ball high enough.

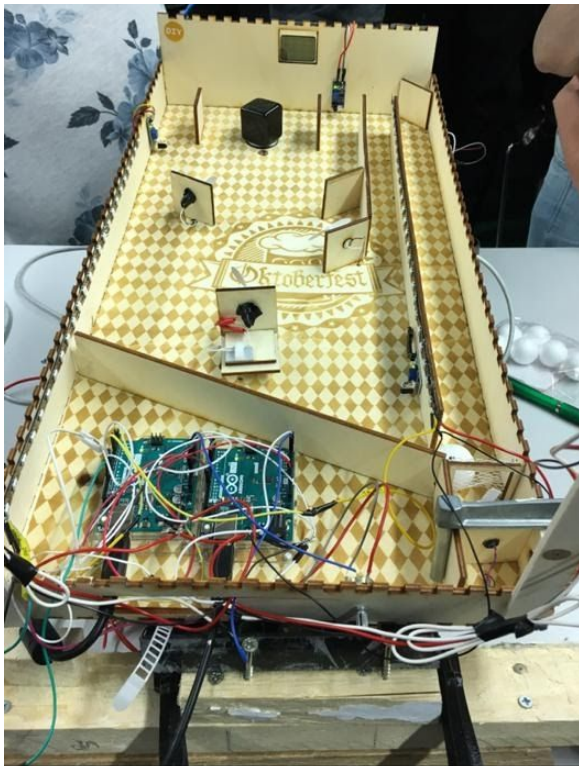
- **Lighting conditions for the infrared sensor:**
  Depending on the time of day and the different lighting conditions in the work area, the infrared sensor had to be readjusted in order to guarantee the correct detection of the balls rolling by.

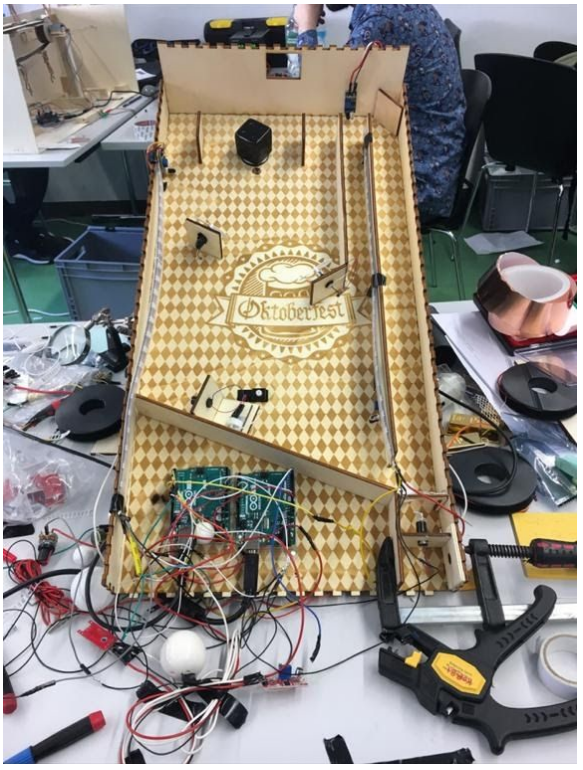
- **Air supply propeller:**
  In order to protect the player from flying balls, a plexiglass disc should be mounted on the pinball machine, but here the air attraction for the rotor blades was deflected at the start ramp and the ball was sucked in as a result and could not be thrown up as planned. To prevent this, you could, for example, drill holes in the game wall behind the start propeller to ensure sufficient air supply.

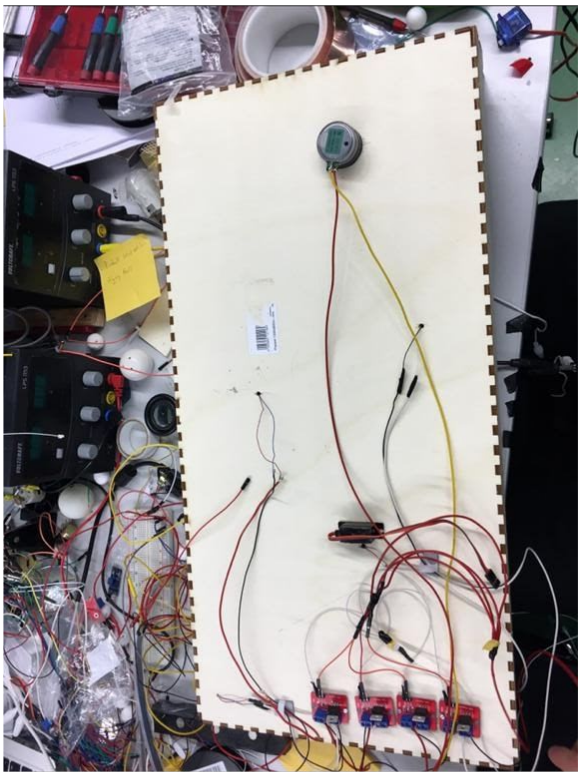
Outlook:
How could we expand the project?

Photos:







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