Swiss Competition 2015

iCAN'15 Swiss Contest – Project Abstract

Project Title : EyeSpeed

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Motivation

Today many sports-tracker apps exist relying only on coarse, low-update-rate GPS data. When tracking performance in sports like skiing – for example in Alaska – with brusque maneuvers or sudden changes in speed, GPS reaches its limits for velocity measurements. GPS measures velocity by measuring two positions with a time difference instead of directly measuring velocity. Inaccuracies of the position information and update rate directly affect the accuracy of the measurements. Additionally, using GPS on a smart phone drains the battery really fast limiting its usage long term. We propose a new device called EyeSpeed for sports velocity measurements based on technology used for aviation for many decades. A custom Prandtl tube will be utilized for relative velocity measurements together with an IMU (Inertial Measurement Unit). The device would allow users to see their real time speed on a flexible display mounted on their googles or glasses. The flexible display is ready for mounting on any commercially available goggles or glasses. The proposed device will enable real time speed measurements and on-line display to the athlete in sports like cycling, skiing, base jumping. This will provide real time monitoring of performance and the athlete can adjust his/her performance on-the-go. The device can simultaneously record or send the data to a smartphone for logging and later analysis. The device can detect accidents and in case of an accident the utilized transmitter will send signals to aid the rescue operation. EyeSpeed makes sport activities more interactive and safer at the same time.

Design and Working Principle

The design of our device is made in a way that it is compatible with almost all commercially available goggles/glasses and helmets. The EyeSpeed is mounted on the helmet whereas the flexible display can be easily mounted to the googles or glasses by the end-user. The EyeSpeed contains a custom Prandtl tube facing the movement direction. At the end of the tube there is a pressure sensor. Another pressure sensor is is placed perpendicular to the movement direction. By monitoring the output of both sensors, the speed is calculated. If necessary, another pressure sensor, installed on the back, can be utilized to account for the wind. Inside the case there is a RFduino board and a battery unit. Additionally, there will be an IMU to sense tilting and a magnetic sensor to act as a compass. The output of all sensors will be read and processed by yhe RFduino to have more precise measurements. The same data will also be used to detect an accident. In case of an accident, all sensors will be switched off and all the battery will be used for the RFduino to transmit emergency signals aiding rescue operations. The flexible display will be connected to the EyeSpeed with a cable.

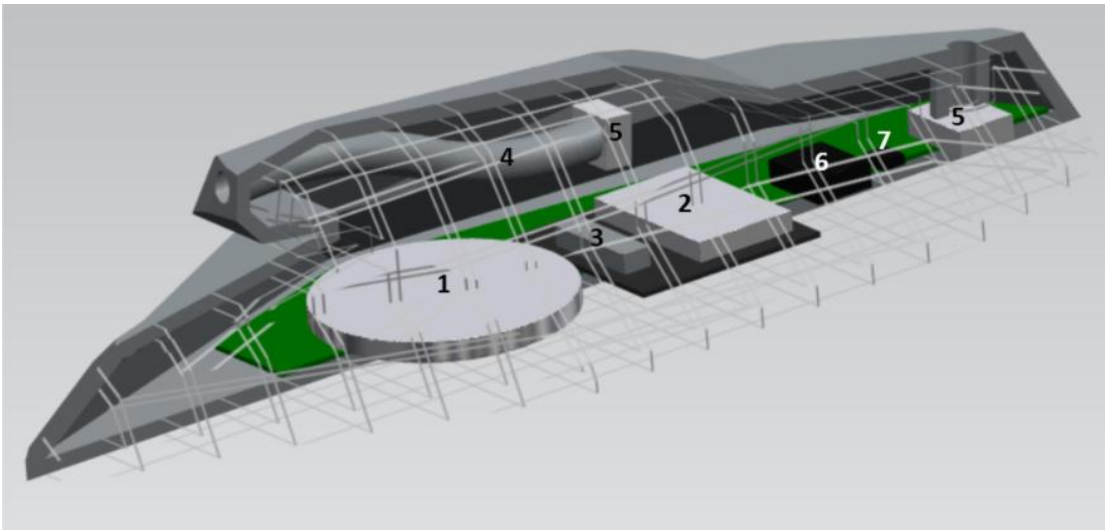


Figure 1 : Cross section of EyeSpeed case (1 :battery ; 2 :RFduino ; 3 : Bluetooth ; 4 : Prandtl tube ; 5 : Pressure sensor ; 6 :IMU ; 7 : Magnetic sensor)

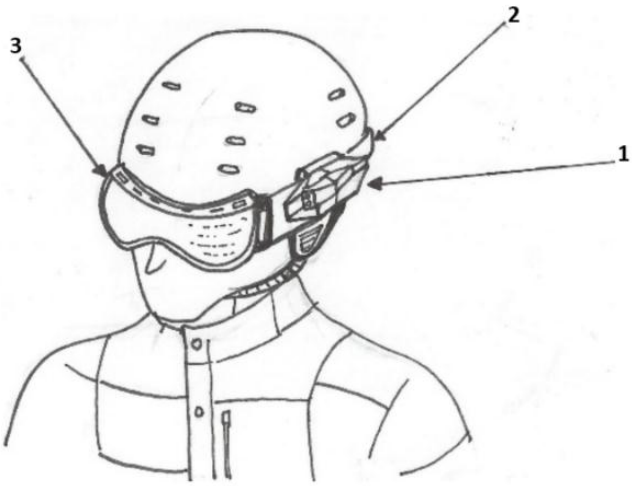
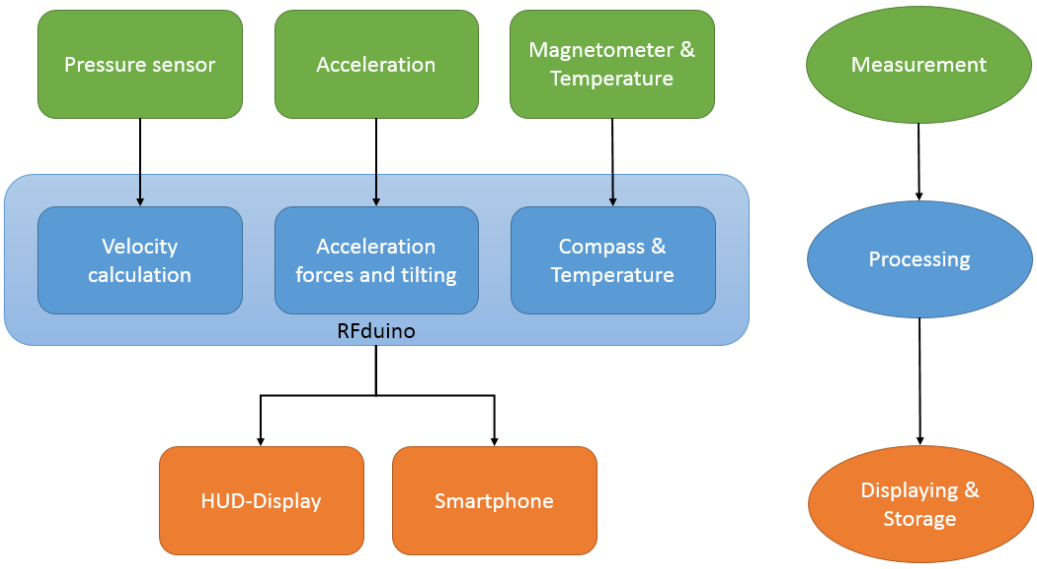


Figure 2 : Idea of Eyespeed (1 : case ; 2 : goggle strap for case attachment ; 3 : goggles with our screen)

Signal flowchart



Required Hardware, used Software and Budget

Hardware	**Purpose**	**Cost / CHF**
RFduino	Main microprocessor (sensor acquisition, control LCD, communication with smartphone)	100
Sensors 15x pressure (Bosch - BMP180) 5x IMU (acc + gyro) (ST - LSM330) 5x magnetic&temperature (ST - LIS3MDL) sensor	Sensing pressure, acceleration and angular rate, magnetic field and temperature	150
Screen	Visualize data to the athlete	250
Battery & Holder	Power supply	50
Housing (3D printed)	3D printing	150
	Total	**700**

For developing the code we will use the open source and free IDE of Arduino using the i2c protocol.

Time Schedule

	Jan				Feb				Mar				Apr				May				Jun			
Tasks	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**	**1**	**2**	**3**	**4**
Design & Concept																								
Components																								
Prototype assembly																								
Software																								
Calibration																								
Experimental verification																								
Testing on the field																								
Presentation (ICAN switzerland)																								
Improving Prototype																								
Experiments																								
Alaska																								