Baseball bat metrics

Setting the scene

Have you ever wondered why some people can hit a baseball faster than others? In this project you will create a sensor which measures the acceleration and direction in which a baseball bat is swung when hitting a ball. You will learn how to use the accelerometer and how to send the data to the cloud ready to be analyzed. A metric is a piece of data which allows the user to analyze their performance. In this project, a range of metrics will be used that are taken from the data gathered using the accelerometer.

Success criteria

* The accelerometer and Arduino can be attached to a baseball bat securely
* Measures the movement of a baseball bat
* Records the data during a bat swing onto cloud

Instructions

The first step is to assemble your device.

Connect the accelerometer to the Arduino using the I2C pins. Connect the button to the Arduino with one side to ground and one side to pin 13.

A circuit board with wires and a square

Description automatically generated

Your device is now assembled and ready to be programmed.

The Accelerometer uses the GY521 library which is included in Arduino cloud.

# Pro-tip

When using a new type of sensor for the first time, it is useful to test it using the sample code that is provided by the manufacturer.

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# Testing your device while attached to the computer

Once you have successfully uploaded the file to your device, you should then select monitor from the left-hand menu. This will show you the readings that your device is currently taking. Move the accelerometer to check that the readings change.

You need these lines of code at the top of the file:

A close-up of a number

Description automatically generated

These lines of code need to be added to setup:

A screenshot of a computer program

Description automatically generatedAnd these lines of code into the loop.

A screen shot of a computer code

Description automatically generated

At this stage, you now know whether or not your device is taking readings by checking the readings on the monitor when you have pressed the button. We now want to send these readings to the Arduino Cloud so that we can see a log of readings from throughout the day.

You should now return to the Arduino IoT Cloud and create a new thing. You should name your thing with a descriptive name and choose the board which it will run on. You should then create float variables for the x, y and z readings and the calculated g-force.

A screenshot of a computer

Description automatically generated

You should now select ‘Edit sketch’. This will take you to the basic code which has been automatically generated. Copy in the same code that you used earlier, but at the end of the loop, add in code to copy the readings to the cloud variables.

A white background with black text

Description automatically generated

You can now upload your program to your device and check in the monitor tab that values are recorded successfully. The Serial.print lines are the commands which are outputting to the monitor.

It is now time to create your IoT dashboard. Click on ‘+Dashboard’.

A green rectangle with white text

Description automatically generated

Create a new dashboard, give it a meaningful name and then add a value widget for X, Y, Z and G-Force. Link the widgets to the cloud variables which you created earlier. You might also like to create a graph and link that to the G-Force cloud variable as well.

A screenshot of a computer

Description automatically generated

Once you have a set of data ready for analysis you could download all recorded data as a csv file by selecting download historic data. You can then either analyse it using a spreadsheet or a programmed application.

# Testing your device is communicating with the IoT Cloud

It is now time to test your device. Move your device in a range of different directions. You should see that the values are displayed on the IoT dashboard. You might need to use a battery and disconnect from the computer for this.

# Attaching your device to a baseball bat

When using the device attached to a baseball bat, we recommend that you power the device with a battery so that it doesn’t need to be attached to a computer. You can use the battery connected provided with the kit.

Connect the red wire to 5V and the black wire to GND. Alternatively, use a USB power bank from a mobile phone and the usual USB cable.

A close up of a circuit board

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It will also need to be within WiFi range. We suggest that you wrap the device with a foam padding to help protect it. Mount the device away from the area where the baseball will be struck.

# Testing your device whilst attached to a baseball bat

Your device should now be securely attached to the bat. Try swinging it at different speeds and different directions. Look at how the measurements change as you swing the bat. You need to press the button to trigger the data capture.

# Stretch tasks

Try purposely hitting a ball in different directions and see which measurements hit the ball the furthest. Can you develop a successful set of metrics which predict the most successful strike?