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Mechatronics project report

Data processing team

Summary

[Introduction 2](#_Toc438083250)

[Motivation behind the topic/ or project 2](#_Toc438083251)

[How to use those one? 2](#_Toc438083252)

[What the allocation of tasks was in your team (i.e. who did what)? 2](#_Toc438083253)

[What are the technical and human factor requirements? 3](#_Toc438083254)

[What difficulties have you encountered at any stage and how did you overcome them? 3](#_Toc438083255)

[Describe how the project influenced your professional development? 3](#_Toc438083256)

[How much the project helped you connect “theory “and “practice” in mechatronics? 3](#_Toc438083257)

[What do you want to remember for a life from this project/class? 4](#_Toc438083258)

[Guide 4](#_Toc438083259)

[Explanation 6](#_Toc438083260)

[Buffer processing 6](#_Toc438083261)

[Conversion decimal to g’s (acceleration unit) 6](#_Toc438083262)

[Warning and improvement 7](#_Toc438083263)

[Warning: 7](#_Toc438083264)

[Improvement: 7](#_Toc438083265)

## Introduction

Our Class team have designed an operational (working) electric circuit prototype. This circuit is to be used for simultaneously gathering acceleration data (in x, y, z directions) at 8 bit resolution. The data shall be stored in an EEPROM memory from where with the help of another circuit it shall be extracted. The extracted data needs to be processed in Matlab where the ultimate goal is to draw the trajectory of the device (rocket) that is experiencing the acceleration.

We were in charge of converting the retrieved binary data to m/s^2 then do math to get velocity and position overtime. We’ll received data from a circuit, those data are acceleration (between -9gs and 9gs) in binary format; and then we’ll convert those data in decimals. The final product should be Matlab plots of acceleration, velocity, displacement over time.

## Motivation behind the topic/ or project

We choose this task because we used matlab for exercise but not in a concrete case like this one. So it was a good idea to use our knowledge on matlab for something concrete and not an exercise. Furthermore we discover how to communicate between two devices with matlab.

Our question was how to receive data and upload it on matlab?

To receive data we’ll use the serial communication: this is the communication between two machines/devices; we can use the serial communication on many programming language (assembly code, c++, matlab.)

## How to use those one?

First we thought that we use an another software to convert the data in a format text and then use it on matlab but we discover that with rs 232 we can received directly on matlab without create a text file to store data on it . We’ll receive in binary in bit format that we’ll convert in decimal to plot the acceleration but also to integrate those values two times in order to get the velocity and the position.

## What the allocation of tasks was in your team (i.e. who did what)?

First we separate in two tasks: we supposed at the beginning we would receive a text file; so Akshay DOMUN did the importation of the data on matlab and the conversion with the bi2de function matlab and Janarthanan MARIASEELAN did the integration of the data and the plots. After we realize that we won’t get a text file but we will have to collect data from the pic by serial communication, and the data that we will received couldn’t be convert with the bi2de function because of the data format (we’ll explain what was the problem exactly on this report later, at “What difficulties have you encountered at any stage and how did you overcome them?). So we did new task: Akshay DOMUN did the serial communication part and Janarthanan MARIASEELAN did the conversion of the data.

## What are the technical and human factor requirements?

A good partnership, communication between our group and the group which will send data from eeprom (electrical erasable program read only memory) to the pic microcontroller where we’ll extract our data.

We need also a circuit made by the hardware team which contain our pic microcontroller

We need Matlab to process with our data (to plot or integrate it).

And we need HyperTerminal. This is a software which check if our circuit send us data. Because if the data management team send us data in the circuit and we received nothing from it ; we’ll check first if the circuit accomplish is function and it will permit us to don’t waste our time.

## What difficulties have you encountered at any stage and how did you overcome them?

Our first difficulty was to find a way to convert binary to decimal correctly:

We find first a function called bi2de to do the conversion but it was doing the conversion but not in the good reading way ( for example when we have ‘ 001’ in binary it’s 1 in decimal but this function instead of reading ‘001’ will read ‘100’ and will give us the number 4 , even if the good answer was one) . We solve that by adding a string in the input of the function for that. Nonetheless to read the binary and convert it this function need to get all of bit with a space between then (it can read “001” but “0 0 1”).

So we’ll use another function (bin2dec) which read string binary data; because the bit we’ll receive won’t be spaced between them. We’ll see how exactly in the program.

The second difficulty was to receive data from the circuit: that was the first time we use serial report and rs-232. One moment we received nothing from the circuit but just five minutes before the team who send the data from the circuit checked and approved that they send data correctly. So we spend time to find out why we received nothing: there was a false contact of a resistor in the circuit.

## Describe how the project influenced your professional development?

The project influenced me a lot ; because that was my first team mechatronic project; as I said before something very concrete not only application of what we saw before , we always discover something new and the challenge was something good for me. Pushing yourself to solve a problem and feeling involved in the project now will help us to be at 100 % or more in the future.

## How much the project helped you connect “theory “and “practice” in mechatronics?

The theory was useful to understand what circuit we were using to received data; it was easier to understand also hardware schematic team. Furthermore when we talk between team the comprehension between each other was very clear because of that.

## What do you want to remember for a life from this project/class?

To not be perplex about the unknown: first time when I heard about what we will do for the project: I was wondering how could we do that; if we never did that before, no exercises, no training. But at the end, with a work hard spirit team , we did it.

Guide:

* If you want to get a publication of the acceleration, velocity and position in a publication by serial communication (without showing the code) :

- Use Hyperterminal to see if the circuit is sending something or not.

- Open matlab => open on it the file called: “projetserialpublishwithoutcode.m”

- Check you have put the good port on you program:

- In the command window, tape: tmtool

- Go to serial

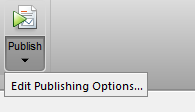


- Click on scan

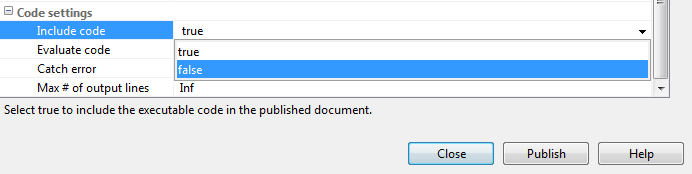
- Look the port which are detected, after the scan

- modify the line code on the program (the input of the function serial) “obj1=serial ('COM4')” , which depend of the scan you did just before **( don’t take the port ‘ COM1’)**

- click on edit publishing



- Put the false the step : show code and click on publish



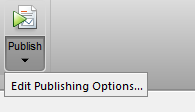
- Just after that link the power supply to the circuit (**don’t do it in the opposite way** otherwise, you won’t receive all the data because if you link the power supply to the circuit, so if you give a tension to the circuit, the circuit will send us already data before we launch our program so we will lose the first data)

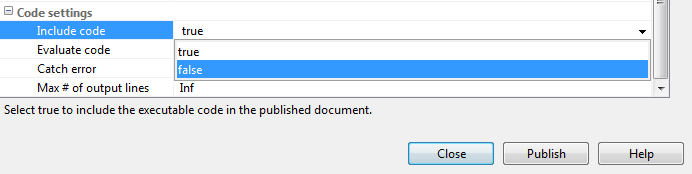
If the command window show an error about fopen go to tmtool and look if there is something in the section instrument object ( if yes delete it and launch it)

* If you want to get a publication of the acceleration, velocity and position from a text file, in a publication without code:
* Open matlab => open on it the file called: “projettextpublishwithoutcode.m”
* Change the name of the file that you want to import on matlab

“filename = 'name.txt'; name of the binary file”

- click on edit publishing

* 
* - Put the false the step to include code and click on publish



If you want to switch easily with the two method:

* Use Hyperterminal to see if the circuit is sending something or not.
* Open matlab => open on it the file called: “projectfinal.m”
* Check you have put the good port on you program:
* - In the command window, tape: tmtool
* - Go to serial



- Click on scan

- Look the port which are detected, after the scan

- modify the line code on the program (the input of the function serial) “obj1=serial ('COM4')” , which depend of the scan you did just before **( don’t take the port ‘ COM1’)**

* Change the name of the file that you want to import on matlab

“filename = 'name.txt'; name of the binary file” (located between line 90 and line 100)

* Launch the program
* Tape a if you want plot of data which from the pic by serial communication or press an another letter to obtain plot of data from a text file
* If you want to get a publication of the acceleration, velocity and position in a publication by serial communication with the main code:

- Use Hyperterminal to see if the circuit is sending something or not.

- Open matlab => open on it the file called: “projetserialpublishwithoutcode.m”

- Open the publish configurator: put the show code to false

- Check you have put the good port on you program:

- In the command window, tape: tmtool

- Go to serial



- Click on scan

- Look the port which are detected, after the scan

- modify the line code on the program (the input of the function serial) “obj1=serial ('COM4')”, which depend of the scan you did just before **(don’t take the port ‘COM1’)**

- Just after that link the power supply to the circuit (**don’t do it in the opposite way** otherwise, you won’t receive all the data because if you link the power supply to the circuit, so if you give a tension to the circuit, the circuit will send us already data before launch our program)

* If you want to get a publication of the acceleration, velocity and position from a text file, in a publication with the main code:
* Open matlab => open on it the file called: “projettext.m”
* Change the name of the file that you want to import on matlab

“filename = 'name.txt'; name of the binary file”

* And click on publish

## Explanation

Matlab will automatically convert binary data to decimal, if those data are from the pic and import on matlab by serial communication but if you import the data from a text file, you need to convert it.

### Buffer processing

The serial program is done by buffer processing that’s mean each operation applied on our matrix will be done when we will receive each element of the matrix (this is the opposite of the streaming processing: the operation will be done when we receive one element: reception of one element, operation on the 1st element, reception of the second element)

### Conversion decimal to g’s (acceleration unit)

The decimals that we receive correspond to a voltage; this voltage correspond to an acceleration after conversion: we just have to know that 0 in decimal correspond to 0 V and -9g and 255 correspond to 3.3 V and 9G. To make it easier we can consider that 0 = -9+9g = 0g so 255 = 18 G

The conversion is by the cross multiplication if Decimals is equal to 3

## Warning and improvement

### Warning:

In the serial program :

For the buffer , take a input buffer which is equal to the number of element of your read before launching your program otherwise the element that you couldn’t read ( because you set a number too low for reading ) will be the save in the buffer , and when you will want to launch it again , you will receive the element that you couldn’t read last time on your new importation.

### Improvement:

In the serial program:

Add a start code in other to avoid that the circuit won’t send data before your launching program when you put a power supply on the circuit.