# Potential group member assessment questionnaire

Please fill out the following questionnaire to help us better analyze how well you would fit into our research group.

**NOTES:**

1. The questionnaire is made up of two parts:
   1. **Career assessment:** In this section, we would like to know your past work experiences, your career intent, your past class performance, and your organizational skills. We will ask you to submit a few documents, such as your résumé, to help us better assess your application in this regard.
   2. **Skills assessment:** In this section, we will ask you to fill out a questionnaire and assess your skills using a Likert scale (typically used in questionnaires). We’ve listed some representative numbers besides each topic; these should give indication of your proficiency. After reading these descriptions, please choose the highest number that describes you, and enter the value in the table below.
2. Please e-mail this document along with any additional documents we ask for as part of the career assessment section as a .zip file titled “Potential group member assessment - <Your name>” to [join-ivsg@psu.edu](mailto:join-ivsg@psu.edu). Please use the same format, i.e. “Potential group member assessment - <Your name>” as the subject line for the e-mail.
3. Your submission will be discussed within the research group before any decision is made. We need to consider if your current skill set ***and*** future potential fits our current or near future requirements. Please be patient and realize that we are actively considering your application.

# Career Assessment

Please include the following documents as a .zip file along with your application.

**NOTE:** Please name each of these documents in the following format: “Potential group member assessment - <Your name> - <Choose one: Resume, Transcript, Cover letter, Writing sample>”

1. **Résumé:** Please include a copy of your up-to-date resume with your application. Your résumé should be at least 1 page long, but no longer than 2 pages. We expect you to include at least the following information in your resume:
   1. **Career intent:** A short one line description of your career intent at the top of the document.
   2. **Current cumulative GPA**
   3. **Work experience – organizational:** We would like to know if you have ever been an intern, if you have experience running projects on your own, and if you have supervised other people before, etc.
   4. **Work experience – skills:** We would like to know if you possess programming, parts fabrication, CAD, control theory, and any other skills relevant to dynamics/control/robotics type work.
2. **Transcripts:** We would like to know what courses you have taken to date. Please include an unofficial copy of your transcript with the application.
3. **Cover letter:** We would like you to include a **one-page** cover letter including the following details:
   1. **Purpose:** Why are you interested in working with our research group? What motivates you to perform research in this area?
   2. **Extra-curricular activities and time commitment:** We would like to know what extra-curricular activities you are involved with and how much of time commitment these activities require on your part. We would also like to know how much of your time will your be able to commit to the research group.
4. **Sample of writing skill:** Please include a term project report or paper you may have written for a course you took.

# Skill Assessment

This section should not take you more than 15 minutes to fill. Please use the rubrics on the pages that follow, and fill in numbers into the slots below.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  | Programming | Mechanical Design | Controls | Sensing | Polish |
| Knowledge | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 |
| Proficiency | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 |
| Application | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 | \_\_\_ of 5 |
| Totals | \_\_\_ of 15 | \_\_\_ of 15 | \_\_\_ of 15 | \_\_\_ of 15 | \_\_\_ of 15 |

For each of the following, select and **change format to bold** for each item that applies to you, and enter the HIGHEST number into the chart above.

## **Programming**

**Knowledge:** How well do you know structured programming?

0 - What is a structured language…?

1 - I have no programming skills…

1 - I know C++,

2 – I know one of FORTRAN, C, Visual BASIC, MATLAB, PASCAL

3 - I have been paid to program in one of the above main languages

3 - I know two of the above, but use one primarily

3 - I know two of the above, and can use both interchangeably

4 - I know two of the above, and know when one is better than the other

4 - I know three of the above

5 - I have been paid to program in at least two of the above simultaneously

5 - I know four or more of the above

**Proficiency:** How often do you program?

0 - I haven’t programmed in at least the last 5 years

1 - I haven’t programmed since my last programming class, but that was within the past 5 years

2 - I haven’t programmed ever outside a class assignment

2 - I program probably once every few months at most

3 - I have one compiler installed on my computer, but use it infrequently

3 - I have one compiler installed on my computer, but use it often enough that I know all the main settings

3 - I write a new program about every week or two

4 - I program enough that I have found intrinsic mistakes in compilers or programming languages, and have sent/posted corrections to the software manufacturer

4 - Other people use my code daily and often comment on how good it is

5 - I program daily and distribute my code to at least 10 people every few months for their critical use and evaluation

**Application Areas:** What have you programmed?

0 - Nothing

1 - My VCR

1 - A PC at school as part of a class

2 - My PC at home as part of a class assignment

2 - My PC at home for out of class assignment

3 - My calculator

3 - A Basic Stamp (or equivalent: BSI, BSII, Atom, BasicX, etc.)

4 - A PIC microprocessor (Microchip, 8086, Motorola HC 811 or 8xx series, Atmel, etc.)

5 - A DSP processor (Texas Instruments, etc.)

5 - An FPGA (Xilinx, etc.)

## **Mechanical Design**

**Knowledge:** How well do you know mechanical design?

0 - um, what?

1 - I had a class on that once, I think

1 - I had a class on that, but it was at least 5 years ago

2 - I had a class on that within the past 5 years

3 - I’ve used mechanical theory outside of class sometime in the last 3 years

3 - I've built something mechanical that has won an award for design

4 - I've built a mechanical system that could kill me if it failed

5 – I’ve had dreams about design structure matrices, and I live in the house of quality.

5 - I've built a mechanical system that could have killed someone else if it failed

**Proficiency:** How often do you use mechanical design tools?

0 - The last time I did a CAD drawing, I was graded on it

1 - I helped my parents in the garage as a kid

1 - I don’t own any tools at home

2 - I own a few tools, but have to borrow quite a bit

2 - I can use AutoCAD or other intrinsically 2-d package

2 - I can fix simple things around the house

3 - I own every tool I have ever needed

3 - If my car breaks down, I could fix it but often don’t due to time involved

3 - I can use ProE or SolidWorks, or other intrinsically 3-D package

3 - I insist on fixing things around the house, even in other people’s houses

3 - I am familiar with experiment design theory such as fractional-factorial designs, ANOVA, etc.

4 - I've sold mechanical things I’ve built (at a profit)

4 - I've built my own tools for specialized projects

4 - I always fix my own car

5 - I use mechanical design tools daily (FEA, FEM, CAD,etc)

5 – I use mechanical design theory daily (HoQ, DSM, etc)

5 - I’ve designed new components for my car

**Application:** What have you designed?

0 - nothing

1 - simple things such as brackets, beam elements, etc, nothing more than 10 man-hours to build

2 - things that move and break due to movement (bearings, gear drives, etc)

2 - things that took no more than 100 man-hours to build

3 - things that convert energy from one domain to another, e.g. electrical to mechanical, or fluid to mechanical, or thermal to electric, etc

3 - things where I had to use very advanced manufacturing methods, e.g. transfer mold, rapid-prototyping, CNC, etc. to create a part

4 - things that cover at least 3 domains of expertise, such as building a robot (requires synthesis across electro-chemical, electrical, mechanical, programming domains)

4 - things that took at least 1000 man-hours to build (this is one year of free time, BTW)

5 - systems with more than 3 domains of knowledge and very specialized equipment, with more than 2000 man-hours to build (this would require you and someone else to work every free hour for one year on your design)

## **Controls and Control Theory**

**Knowledge:** How well do you know controls and automation?

0 - nothing

1 - I know how PID control works and can probably tune one

2 - I can design a state-space controller

3 - I can design an LQR or LQG controller

3 - I understand the performance versus robustness tradeoffs in the frequency domain

4 - I can design a H-infinity or adaptive controller

4 - I can design/tune a Kalman filter

4 - I understand the internal model principle

5 - I can design a hybrid controller and guarantee performance over all domains of operation, even switching stability using Lyapunov methods

5 - I can design an LMI controller, or have strong familiarity with multivariable Nyquist bounds for robust controllers

**Proficiency:** How often do you design controllers?

0 - never

1 - in one or two classes

2 - once and a while in my research lab or student project

2 - fiddled with them at home for a couple projects

3 - once a month or so

4 - this is my research area

5 - I have dreamt about controllers… I was the “D” term last night in a wickedly nonlinear system! Bring it!

5 - I have been invited to teach how to do controller design

**Application:** Most of the struggle with controller implementations is the interface between systems. Which of the following are you familiar with?

0 - I have trouble controlling my temper

1 - I have read signals such as digital I/O and/or analog I/O using a DAQ board (NI, Computerboards, etc)

1 - I can build something that moves based on electronic measurements

2 - I have used RS232 to control something

2 - I can control position of a motor, if you give me some time, equipment

3 - I have used CAN or I2C to control something

3 - I have used an RT kernel or platform such as RTLinux, xPC, DSpace, etc.

3 - I have controlled pieces of equipment more expensive than a car

4 - I understand core constructs necessary for real-time implementation such as semaphores, interrupts, and/or queues

4 - I have controlled pieces of equipment more expensive than a house

5 - I have developed peer to peer embedded real-time data exchange via RTX DDS, Opal RT, UDP, etc

5 - I have controlled pieces of equipment that could kill someone if my controller stopped working (spacecraft, pacemakers, etc)

## **Guidance and Sensing**

**Knowledge:** Which of the following guidance/sensing theories are you familiar with?

0 - nothing

1 - I know how to average numbers

2 - I can do coordinate transformations

2 - Nyquist sampling theorem and aliasing

2 - A Whetstone bridge

3 - FIR and IIR discrete implementations of causal filters, Butterworth filters, Chebyshev filters, etc.

3 - Observer design in state-space, possibly including Luenburger observers

4 - Kalman filtering

4 - Fitting Markov process models of stochastic systems

4 - SLAM

4 - A-star, D-star, or Potential Field approaches

5 - Unscented Kalman filtering

5 - Vision processing including Locus-Kanade algorithms, etc.

5 - Extended Kalman Filters

5 - Particle filters

**Proficiency:** Which of the following sensing challenges, if you were asked to complete by 5 pm tomorrow and had any raw sensing equipment you wanted at the ready, could you easily get a computer or microprocessor to do?

0 - define “sensor”

1 - instrumenting the door to detect if it is open or closed

2 - detecting the voltage remaining on the battery of a robot

2 - detecting how much a wheel on a robot has spun

3 - finding the distance to something within arms reach of a robot

3 - finding the orientation of the robot in roll, pitch, and yaw

3 - finding the position of a robot outside

4 - measuring something in this room and posting the results in real-time to a webpage

4 - finding the position of a laser spot projected on a wall in front of the robot

4 - finding the exact velocity of a non-collocated moving system, for example measuring flying robot, flying outdoors, resolved to 100th of a second

5 - finding the position of the robot navigating a twisting stairwell, using only inertial sensors and odometry, or position/orientation of a flying robot.

**Application:** Which sensors have you used in the past as a design element for something you have made?

0 - nothing

1 - a digital switch

1 - a thermometer (or thermocouple or RTD)

1 - a potentiometer

2 - an encoder

2 - a hall-effect sensor

2 - a Sharp PSD (GP2D02 or equivalent)

3 - ultrasonic rangers

3 - digital compass

3 - laser proximity sensor

3 - accelerometer or rate gyro (or other inertial sensor)

4 - laser scanner

4 - GPS or DGPS

5 - machine vision systems

## **Polish and Presentation**

**Knowledge/Experience:** What is the largest group you have ever presented in front of?

0 - my class, 20 people in teaching arena

1 - my research group, 20 people in technical arena

2 - at a conference, 50-100 people

3 - one of several main speakers at an event, 100+ people

4 - I was a keynote speaker, 300+ people

4 - I have been paid more than $500 to speak in the past

5 - I have won major regional, national, or international speaking awards

**Proficiency:** What are your writing abilities?

0 - I are a very excellent righter!

1 - I struggle to express myself

2 - I can compose an E-mail, but not an essay

2 - I keep a daily journal, blog, etc.

3 - I have read and own “Elements of Style” (if you don’t know what this is, then you aren’t above a 3 and skip the following)

4 - I have written entire articles for fun

4 - I have been paid for my articles in popular press

4 - I have published at least 3 journal articles

5 - I have won major writing awards

**Application:** What are your web / GUI capabilities?

0 - What do sticky spiders have to do with this class?

1 - I host a personal webpage, but Flash and XML are beyond me

2 - I host a webpage, and might understand the raw HTML.

3 - I host individual webpage for my research group or student club, which includes a number of style elements

4 - I have been paid to develop a web page or app for someone

5 - I have won awards for web or app design