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Python For Robotics

During my last semester at Southwestern Adventist University, I decided to take an independence studies class. Last year in the spring 2021 semester I had the opportunity to take an introduction to the robotics system class. In that class, I was able to have a better understanding of how robots work and how complex these systems really are. I became curious about this topic and at the same time, I started to respect it more. Last fall semester Dr. Thomas shared with me an event that was going to take place in March 2022. The event FIRST LEGO League was hosted by Southwest Region Conference pushed me to learn how the LEGO SPIKE PRIME system works. When using this system, we have three options for how to communicate with the hardware: icon blocks, word blocks, and python. I choose to work with all of them to understand how they work but I focus on python.

At the end of spring break, I had the opportunity to be a judge in the FIRST LEGO LEAGUE hosted by the Southwestern Region Conference. I was not sure what to expect, but it was a good experience. It was amazing to see the kids designing, creating, and programming their lego robots. It was also good to see the kids learning everything they could about robots, I wish I had an opportunity like that when I was their age. In my role as a judge, I got to score the innovation project. Most of the projects were not applicable in real life but it amazed me how the kids thought so much about making things easier in the transportation industry. Some projects focused on the person deriving the mail and packages. The kid's intentions were pure and it was refreshing to see how kids think and worry about others. It made me think about how developers

and problem solvers focus sometimes on the thing that gives us the most money. We should think and worry about other people. The robots were quite interesting, the designs were complex for a kid and I was amazed to see their work. The thing that I was the most curious about was the code the kids developed. I was hoping to see maybe some python code but all the teams were using command blocks, which I was expecting. It was my first experience as a judge and it thought me so much. I was able to learn how to be a judge and what a judge is looking for in a presentation of a project which helped me to do better in my presentations. Overall it was a great experience, I am curious to see how computer science students would do in an event like this and the designs they would create. I am thankful for the opportunity Dr. Thomas.

As mentioned before there are three ways to talk to the robot. I choose python as to communication method. I decided to use python because I did not know python and I wanted to learn. Python is used in different places and types of projects like websites and software, automate tasks and conduct data analysis. It was an interesting experience to learn python because is different from anything else I know. In the beginning, I struggle with indentation, how there are no brackets to see where a function ends and how there are no semicolons. It was frustrating sometimes but in the end, it got a bit easier to use. Something really surprising to me is how easy and short was the robot's script. It was also quite easy to code with python since the LEGO SPIKE PRIME system is built for beginners and the system creates an environment ideal to learn python. The LEGO SPIKE PRIME has an IDE include that provides us with the libraries we need and all the different functions available for the robot. After my studies with python, I can understand why python is the programming language taught to kids. It is easy to understand

and the libraries have made things a lot easier and made learning faster. I am curious to see how professionals use this programing language in real robotics.

When taking the introduction to the robotics system class I got to work with a robot that Dr. Thomas and some students put together and we communicated using c++. During that semester, most of the time was used to figure out how to connect the hardware and make it talk to each other. We tried to connect a mapper to the robot but we were not able to make it work. It was a frustrating experience but I learned how much work is put into robotics and complex those systems really are. What took half of the semester, I was able to do in one hour with the LEGO SPIKE PRIME system. I was able to put together all the sensors and pieces necessary to make the robot work. With C++ we have to code everything and make sure we connect things properly so that all sensors can operate correctly. Using python it was as easy as typing a couple of lines and all the sensors were up and running. C++ is the second programming language I learned and it is my favorite, that is why I had a hard time coding with python because indentation is important in python and there are no brackets. I know there is a lot of python I did not get to use but I found it interesting how easy the community has made things for other developers using different libraries. There is another programming language I use a lot call Flutter/Dart and there are some aspects in which there are similar. Both python and dart are high-level programming languages, in dart, there are a lot of functions that make development easier. In Dart, we can write a build in a function that connects to a camera or reads QR codes. There are a lot of functions already created for us to use. So knowing dart was also helpful when learning python.

I think python is useful for different things for developers. The immediate use for python is to teach since is easy to learn and use, making teaching easier. That is why most kids are introduced to programming through python. Since python has been around for quite some time, there is a large community, they all support their community by creating libraries and teaching new developers. So when learning python and developing with this language, we will not find ourselves alone. There are big companies that use python like Google, Facebook, and Amazon Web Services to name a few. Once we know our way around python, new jobs opportunities can come our way. In my experience the main reason why developers like python are because it reduces the developing time by a lot. Projects that might take a year to develop using C++, with python can take as little as two months. Those are the main reasons why I think python is so important to know even if it is not the main programming language we use.

I would like to share a sample that I wrote for the robot using python. The purpose of the robot was to advance while there were no obstacles in front of it. If the robot saw something in its way then the robot would turn and keep going.

Connect

```
from spike import PrimeHub, LightMatrix, Button, StatusLight, ForceSensor, MotionSensor, Speaker, ColorSensor, App, DistanceSensor, Motor, MotorPair
from spike.control import wait_for_seconds, wait_until, Timer
from math import *

hub = PrimeHub()

motor_pair = MotorPair('A', 'E')
distance_sensor = DistanceSensor('B')
distance_sensor.light_up(100, 100, 100, 100)

def Move(Power, Steering):
    motor_pair.start_tank(Power - Steering, Power + Steering)

while True:
    distance = distance_sensor.get_distance_cm()
    if distance == None:
        Move(70, 0)
    elif distance <= 20 :
        Move(20, 35)

```

In the first three lines, we are importing all the libraries necessary to be able to connect to the robot. In line five, we are creating the hub. Line seven we are paring motors A and E making directions and rotations easier to operate. Line eigh we are declaring the distance sensor which is going to be useful to see how close we are to an obstacle. Line eleven and twelve, we are defining a function that asks for the power (how fast the motors will rotate) and the steering (how many degrees the motors would move). In line fourteen we create a while loop. In line fifteen, we get the distance that returns the distance of the sensor in centimeters and we convert it to an integer. Line sixteen checks if the distance is none (the function returns none if the distance is greater than 200 cm) and if the condition is true, the motors will move at seventy percent capacity. If the condition is not true and the distance is less or equal to twenty cm then the robot will rotate thirty-five degrees at twenty percent speed. The robot will continue doing this until we decided to stop the program.

In conclusion, python is used for different purposes around the world and it is a programming language that we should know how to work. Python was easy to learn and use for the purpose of my studies during this semester. Seeing the kids in the tournament using the robots they created was refreshing to see, it was an amazing opportunity to be part of something like that. I think learning how to code is very important because it teaches us and helps us to think logically and the earlier we learn that, the better. Thank you, Dr. Thomas, for the opportunity to learn and work with the LEGO SPIKE PRIME.