Florida Tech IGVC Milestone 5 Report

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Milestone V

Task Matrix

#	Task	% Complete	Brent	Adam	Chris	Will
1	LiDAR & Lines	75%	0%	15%	85%	0%
2	Software Integration	67%	25%	25%	25%	25%
3	Software Testing	50%	25%	25%	25%	25%
4	Hardware Integration	25%	25%	25%	25%	25%
5	Motion Planning	100%	100%	0%	0%	0%
6	GUI	75%	100%	0%	0%	0%
7	Startup, Control, Logging	50%	10%	20%	0%	70%
8	Comm. Maintenance	100%	10%	10%	10%	70%
9	IOP	0%	0%	70%	0%	30%
10	Create Poster	100%	25%	25%	25%	25%

Discussion

Task 1

Chris refined line detection to clearly defined lines. Lines are well defined when the image has a uniform light level. Calibration for dealing with different light levels still needs to occur. Additionally, the best version of the code running on the CPU takes sub-second time for calculations. The OpenCV CPU and GPU code is nearly equivalent so converting to a GPU will be simple. A significant speed up with the GPU code is expected.

FSU would not release the LiDAR to us so they have taken over programming it.

Tasks 2 & 3

Both software integration and testing are lagging simply because development is still occurring. The additional ROS components need to be tested, and though logging and communication issues were resolved, the additional components still need to be integrated. A simple simulation will be written to test the motion planner's interaction with motor control, line detection, and obstacle detection.

Task 4

Unfortunately, neither the LiDAR nor the robot are at Florida Tech. Florida State University would not release the LiDAR to us. The robot just needs to be driven down here. It is hard for us to do integration without the robot.

Task 5 & 6

Brent implemented D* within SBMPO improving the time for calculations by a factor of 10. To make D* work within SBMPO Brent added another dimension based on the robot's orientation. This orientation dimension actually improves the quality of the paths significantly.

Task 7

Logging issues have been handled for all of the components. Starting up most of the components is possible through RabbitMQ. ROS allows us to startup components directly. The run scripts are kind of pointless right now because we still are writing the startup for components. Fortunately, components of the software have been parameterized to run with an IP and port number provided at run time to hook up to the RabbitMQ-Server.

Task 8

A tie in to ROS has been written. The components written in C++ have just been integrated into the ROS build which uses CMake. To make the build work the libraries were converted to shared object libraries and the path to those libraries is now placed into a folder added to the path. More improvements to the framework require finished software components and some hardware components.

Task 9

Contact has been made though the competition planners remain unhelpful. We have collected more information regarding IOP through talking to previous competition attendees. At this point we may begin coding what we think IOP should concern especially the security aspects of IOP.

Task 10

The poster is complete and being printed for the showcase. Graphics and images were found as well as extensive data taken. For the showcase we will have multiple demos of individual pieces of software running.

Contributions

Adam Hill

Adam bounced around working on IOP, run scripts, and startup issues. He has kind of been hamstrung by the lack of communication from the competition.

Brent Allard

Brent improved the motion planning algorithm by using D* Lite and improved path accuracy significantly. The GUI written by Brent will be very useful at the showcase. Brent will interface the motion planner with other components and contribute to testing software.

Chris Kocsis

Chris has improved his line detection software and now needs to code various edge cases. His new implementation uses several algorithms from white papers on the subject and runs at sub-second speeds even using a CPU.

Will Nyffenegger

Will improved the logging and communication framework while fixing issues. Will also combined RabbitMQ into ROS nodes for interfacing with the motion planner and other components on devices that do not support ROS.

Milestone VI

Note: until FSU sends a physical robot to the team there is very little integration we can do. Several of our engineering team members are currently hamstrung and soon both Adam and I will be as well. Our results are contingent on getting that robot.

Task Matrix

#	Task	Brent Allard	Adam Hill	Chris Kocsis	Will Nyff.
1	Lidar & Lines	0%	25%	75%	0%
2	Testing & Integration	25%	25%	25%	25%
3	Motion Planning & GUI	100%	0%	0%	0%
4	Startup, Control, & IOP	10%	60%	0%	30%
5	Comm. Maintenance	10%	10%	10%	70%
6	Demo Video	25%	25%	25%	25%
7	Documentation	25%	25%	25%	25%

Discussion

Task 1

Lines currently being detected need to be placed into a standardized format then conveyed to the motion planner. If possible the line detection software will be applied for obstacle detection. Originally, the ZED was positioned at a 45-degree angle. Recently, with polarized film, the angle of the ZED has been raised significantly. This change in angle may allow us to do practical obstacle detection.

Task 2

Once we have the robot we will proceed to put everything together. Though true integration testing without the robot is difficult, tests of several software components will occur. Our main goal is to have a functional robot so testing will focus on critical components like motion planning, line detection, position estimation, and Lidar.

Task 3

A short simulation to test the motion planner will be written and testing the interface will continue. Most of the remaining work on the motion planner revolves around integration and testing.

Task 4

Startup scripts need to be written with notice taken of the time required to calibrate a GPS from a cold start. Additional datatypes and synchronization constructs need to be created to handle the

remaining data reporting to the control unit. Responses to exceptions encountered in components need to be created.

Task 5

Components for the Lidar, INS, and robot localization nodes need to be completed. Until FSU's code is posted online it will be impossible; afterwards, adding the components will be simple.

Task 6

A demo video of the robot on a fake course will be completed. This is completely contingent on us receiving the robot before the senior design showcase.

Task 7

Documentation for the robot using Doxygen will be completed as will extensive documentation required for the competition.

Faculty Sponsor Signature

Sponsor Signature

Evaluation:

William Nyffenegger	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Chris Kocsis	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Brent Allard	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Adam Hill	0	0.5	1	1.5	2	2.5	3	3.5	4	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10