

FIRST Team 3620

2013 Robot Redo Software Specification and Design

2013/10/19 11:47:48

Contents

1	Requirements	3
1.1	Autonomous Requirements	3
1.1.1	Box	3
1.1.2	Shoot3	3
1.2	Teleop Requirements	3
1.2.1	Driving	3
1.2.2	Lift	3
1.2.3	Shooter	3
1.2.4	Flipper	3
1.2.5	Auger	3
1.2.6	Harvester	3
1.2.7	ShooterTilt	4
2	Coding Guidelines	5
2.1	Capitalization	5
2.2	Naming	5
2.3	Command-Based Programming Common Practices	5
3	Design	6
3.1	Robot	6
3.2	Autonomous Commands	6
3.3	DriveSubsystem	6
3.3.1	Actuators, Controllers, and Sensors	6
3.3.2	Commands	6
3.3.3	Public Methods	7
3.4	LiftSubsystem	7
3.4.1	Actuators, Controllers, and Sensors	7
3.4.2	Commands	7
3.4.3	Public Methods	8
3.5	ShooterSubsystem	8
3.5.1	Actuators, Controllers, and Sensors	8
3.5.2	Commands	8
3.5.3	Public Methods	9
3.6	FlipperSubsystem	9
3.6.1	Actuators, Controllers, and Sensors	9
3.6.2	Commands	10

3.6.3	Public Methods	10
3.7	AugerSubsystem	10
3.7.1	Actuators, Controllers, and Sensors	10
3.7.2	Commands	11
3.7.3	Public Methods	11
3.7.4	Internal Methods	11
3.8	HarvesterSubsystem	11
3.8.1	Actuators, Controllers, and Sensors	11
3.8.2	Commands	12
3.8.3	Public Methods	13
3.9	ShooterTiltSubsystem	13
3.9.1	Actuators, Controllers, and Sensors	13
3.9.2	Commands	13
3.9.3	Public Methods	14
3.10	Operator Interface	15
A	RobotMode.java	16

1 Requirements

1.1 Autonomous Requirements

Operator can pick one of these from the SmartDashboard.

1.1.1 Box

Robot drives in a box.

1.1.2 Shoot3

Robot shoots 3 preloaded discs in place.

It actuates the tilt, sets the tilt to some angle (that comes from the dashboard), then in parallel starts the shooter wheels, indexes 1. After index is complete, it double pumps the flipper, indexes the next disk, double pumps, indexes, and double pumps. It then turns the shooter wheels off, and sets the tilt to 0 degrees.

1.2 Teleop Requirements

There are 3 user interface elements on the driver's station: a driver's joystick, a shooter's joystick, and a custom control panel for manually working the disk handling elements of the robot.

1.2.1 Driving

The driver's joystick controls the motion of the robot on the floor. The robot usually uses 4 of the 6 motors; if the Turbo button is depressed, all 6 motors are used. The driver joystick also has a "reverse" button that toggles the robot between forward and reverse mode; when in reverse, the robot drives as if the rear of the robot is now the front.

1.2.2 Lift

There are 2 lift buttons on the driver's joystick. While the "up" button is pressed, the lift extends, while the "down" button is pressed, the lift retracts.

1.2.3 Shooter

There is a button on the driver's joystick that, while held, turns the shooter on. If the shooter is on, then the desired front speed is controlled by driver's speed up and down buttons. There are 2 speeds. The desired and actual RPM are displayed on the dashboard.

1.2.4 Flipper

When the shoot button on the driver's joystick or control panel is pressed, the flipper will move out for so long, wait for so long, retract for so long, then turn off. The control panel has a manual override toggle switch to work the flipper motor either forwards or backwards while the switch is actuated.

1.2.5 Auger

If the switch at the bottom of the auger is hit, then the auger will index up one disk position, unless there is a disk at the top. There is a toggle switch on the control panel that will moves the auger either up or down while the switch is actuated.

1.2.6 Harvester

There is a button on the driver's joystick that toggles the harvester wheels and the belts on/off state. There are toggle switches on the control panel that override the on/off setting for the belt and harvester wheels separately. When the toggles are in the middle, the on/off setting prevails (when toggled on, the belt and harvester bring disks inward).

1.2.7 ShooterTilt

There is a button on the shooter's joystick that turns the tilt motor on and off. If the tilt motor is on, then the desired angle is controlled by up and down buttons on the shooter's joystick. Each depression moves the tilt 30 degrees up or down. The limits of travel are 0 and 60 degrees. The actual and desired tilt are displayed on the dashboard.

2 Coding Guidelines

2.1 Capitalization

- Packages are all lower case: `org.usfirst.frc3620.name` (`org.usfirst.frc3620.robotredo`)
- Classes are capitalized and camel-cased.
- Methods are lower case and camel-cased.

2.2 Naming

- Projects are named `FRC3620yyyyname` (`FRC36202013RobotRedo`)
- Subsystem classes have `Subsystem` at the end of the name: `DriveSubsystem`.
- Command classes have `Command` at the end of the name, and the name of the subsystem they work with at the beginning `DriveArcadeDriveCommand`.
- If a command works several subsystems, then I don't know what to put at the beginning of it's name.
- Autonomous....

2.3 Command-Based Programming Common Practices

Generally, methods are put into the subsystem to write to or read from the hardware; these routines should do as much as possible to disguise the hardware (in case we need to make a hardware change). If a Command is written so that it using an actual hardware device (`DigitalIO`, `Victor`, whatever), then something needs to be looked at.

- We have a `RobotMode` class; it is used to indicate what mode the robot is in (disabled, autonomous, teleop, test). This is passed into `void periodic()` methods in the subsystems.
- There is a `periodic(RobotMode)` method added to the `Robot.java`. The `teleopPeriodic()`, `autonomousPeriodic()`, `disabledPeriodic()`, and `testPeriodic()` methods all call `periodic(RobotMode)`. This method calls the `periodic(RobotMode)` in each of the subsystems that need it, and updates the dashboard and network tables with any robot-wide information. The subsystem's `periodic(RobotMode)` methods update the dashboard and network tables with subsystem information.
- There is a `onRobotModeChange(RobotMode)` method added to the `Robot.java`. The `teleopInit()`, `autonomousInit()`, `disabledInit()`, and `testInit()` methods all call `onRobotModeChange(RobotMode)`. This method calls the `onRobotModeChange(RobotMode)` in each of the subsystems that need it. Subsystems use this routine to reset any information that needs changing with the robot makes a change to a new mode (such as entering or leaving test mode).
- Subsystems may have a constructor added to them if they need to do one-time processing, such as setting up custom Buttons that are actuated by on-robot hardware (custom Buttons that are actuated by operator interface are set up in `OI.java`).

3 Design

3.1 Robot

3.2 Autonomous Commands

There will be two Autonomous commands: AutonomousBoxCommand and AutonomousShoot3Command.

3.3 DriveSubsystem

The default command will be the DriveArcadeCommand command.

3.3.1 Actuators, Controllers, and Sensors

PrimaryDrive is the drive for 4 of the 6 drive motors.

SecondaryDrive is the drive for the remaining 2 drive motors.

Gyro is the gyro used to measure turn.

DriveEncoder is the encoder used to measure distance traveled.

3.3.2 Commands

3.3.2.1 DriveArcadeCommand should be the default command for the subsystem.

requires DriveSubsystem
initialization None.
execute Uses the arcadeDrive method to drive the robot.
isDone Runs until interrupted.
end Turns off drive.
interrupted Same as end();

3.3.2.2 DriveTurnInPlaceCommand(double *degrees*) is used to turn *degrees* degrees. Negative values are to the left, positive values are to the right.

requires DriveSubsystem
initialization use resetGyro()
execute Uses the arcadeDrive method to drive the robot.
isDone finishes when the robot has turned far enough.
end Turns off drive.
interrupted Same as end();

3.3.2.3 DriveMoveInLineCommand(double *meters*) is used to move *meters* meters. Positive values are forward, negative values are backward.

requires DriveSubsystem
initialization use resetEncoder()
execute Uses the arcadeDrive method to drive the robot.
isDone finishes when the robot has moved far enough.
end Turns off drive.
interrupted Same as end();

3.3.2.4 DriveToggleReverseCommand() toggles "reverse mode".

requires Nothing
initialization None
execute use the subsystem's "toggle reverse" method.
isDone Runs once.

end Turns off drive.
interrupted Same as end();

3.3.3 Public Methods

public void arcadeDrive (GenericHID hid, **boolean** turbo)
 drives the robot using just the PrimaryDrive if turbo is false, or both PrimaryDrive and SecondaryDrive if turbo is true.
 The robot drives in reverse if reverse mode is toggled on.
public void drive (**double** outputMagnitude, **double** curve)
 uses the PrimaryDrive to drive the robot. This is for use by autonomous modes.
public void halt ()
 stops all drive motors.
public void resetGyro ()
 resets the gyro.
public double readGyro ()
 reads the gyro heading in degrees.
public void resetEncoder ()
 resets the encoder.
public double readEncoder ()
 reads the distance traveled in meters.
public void toggleReverseMode ()
 toggles the reverse mode flag.
public void setReverseMode (**boolean** reverse)
 sets the reverse mode flag to *reverse*.
public boolean getReverseMode()
 returns the current value of the reverse modem flag.

3.4 LiftSubsystem

3.4.1 Actuators, Controllers, and Sensors

ChinupController is the Victor controller for the chinup motors.

3.4.2 Commands

3.4.2.1 LiftExtendCommand extends the lift.
requires LiftSubsystem
initialization None.
execute Uses the liftExtend method to extend the lift.
isDone Runs until interrupted.
end liftHalt()
interrupted Same as end();

3.4.2.2 LiftRetractCommand retracts the lift.
requires LiftSubsystem
initialization None.
execute Uses the liftRetract method to retract the lift.
isDone Runs until interrupted.
end liftHalt()
interrupted Same as end();

3.4.3 Public Methods

```
public void liftRetract()
retracts the lift (lifts the robot).
public void liftExtend()
extends the lift (lowers the robot).
public void liftHalt()
freezes the lift.
```

3.5 ShooterSubsystem

The front shooter runs at either 800 or 1600 RPM.

3.5.1 Actuators, Controllers, and Sensors

FrontShooterController is the Victor controller for the front shooter motor.

ReadShooterController is the Victor controller for the rear shooter motor.

FrontShooterCounter is the Counter for the front shooter motor.

FrontPID is the PID controller for the front shooter motor.

3.5.2 Commands

3.5.2.1 ShooterRunRearShooterCommand is the default command for the subsystem, it keeps the rear motor power set. The front motor power does not need to be set here because the FrontPid PIDController keeps the front motor power set.

```
requires ShooterSubSystem
initialization None.
execute Send the desired motor power (getDesiredRearMotorPower()) to the rear shooter motor
        (setRearMotorPower())
isDone Runs until interrupted.
end shuts down the rear shooter motor (setRearMotorPower()).
interrupted Same as end();
```

3.5.2.2 ShooterFasterCommand bumps the desired RPM for the front shooter.

```
requires nothing (we don't want to interrupt any commands)
initialization None.
execute Bumps the desired RPM up.
isDone Runs once.
end nothing
interrupted Same as end();
```

3.5.2.3 ShooterSlowerCommand bumps the desired RPM for the front shooter.

```
requires nothing (we don't want to interrupt any commands)
initialization None.
execute Bumps the desired RPM down.
isDone Runs once.
end nothing
interrupted Same as end();
```


3.5.2.4 ShooterButtonCommand turns the shooters on while running.

requires nothing (we don't want to interrupt any commands)
initialization None.
execute *needs work*
isDone Runs until interrupted.
end *needs work*
interrupted Same as end();

3.5.2.5 ShooterOnCommand turns the shooters on.

requires nothing (we don't want to interrupt any commands)
initialization None.
execute setRearShooterPower(), enableFrontPID()
isDone Runs once.
end nothing
interrupted Same as end();

3.5.2.6 ShooterOffCommand turns the shooters on.

requires nothing (we don't want to interrupt any commands)
initialization None.
execute setRearShooterPower(), disableFrontPID()
isDone Runs once.
end nothing
interrupted Same as end();

3.5.3 Public Methods

```
public void setDesiredFrontRPM (double rpm)
```

sets the desired speed for the front shooter motor.

```
public double getDesiredFrontRPM ()
```

gets the desired speed for the front shooter motor.

```
public void setDesiredRearMotorPower (double power)
```

sets the desired power for the rear shooter motor (saves the desired power).

```
public double getDesiredRearMotorPower ()
```

gets the desired power for the rear shooter motor.

```
public double getCurrentFrontRPM ()
```

gets the current (actual) speed for the front shooter motor.

```
public void enableFrontPID ()
```

starts the PID controller for the front motor.

```
public void disableFrontPID ()
```

stops the PID controller for the front motor.

```
public void setRearShooterPower(double power)
```

set the power for rear shooter motor. Actually pokes the motor controller.

```
public setFrontShooterPower(double power)
```

sets the power for front shooter motor. Actually pokes the motor controller. If the specified power is greater than 0.5, cap it at 0.5.

3.6 FlipperSubsystem**3.6.1 Actuators, Controllers, and Sensors**

FlipperSpike is the Spike controller for the flipper motor.

3.6.2 Commands

3.6.2.1 FlipperFlipCommand extends the lift.

requires FlipperSubsystem
initialization save the current time.
execute Uses flipperForward() to move the flipper forward for so long, flipperHalt() for so long, flipperBackward() for so long.
isDone Runs until the flipperBackward at the end is done.
end flipperHalt()
interrupted Same as end();

3.6.2.2 FlipperAutonomousFlipCommand pumps the flipper multiple times.

requires FlipperSubsystem
initialization save the current time.
execute *needs work*
isDone Runs until the flipperBackward at the end is done.
end flipperHalt()
interrupted Same as end();

3.6.2.3 FlipperForwardCommand moves the flipper forward while running.

requires FlipperSubsystem
initialization None.
execute Uses flipperForward() to move the flipper forward.
isDone Runs until interrupted.
end flipperHalt()
interrupted Same as end();

3.6.2.4 FlipperBackwardCommand moves the flipper backwards while running.

requires FlipperSubsystem
initialization None.
execute Uses flipperBackward() to move the flipper backward.
isDone Runs until interrupted.
end flipperHalt()
interrupted Same as end();

3.6.3 Public Methods

public void flipperForward()
 moves the flipper forward.
 public void flipperBackward()
 moves the flipper backward.
 public void flipperHalt()
 turns the flipper motor off.

3.7 AugerSubsystem

3.7.1 Actuators, Controllers, and Sensors

AugerController is the Victor controller for the auger motor. *Chris: check the old robot; this could be a Spike. If so, make the change here.*

AugerLimitSwitch is the digital input for the limit switch.

AugerEncoder is the position encoder for the auger.

3.7.2 Commands

3.7.2.1 AugerIndexCommand indexes the auger one frisbee.

requires AugerSubsystem
initialization Record the current time.
execute Uses the augerUp method to move the frisbees.
isDone Runs when then auger is indexed and the elapsed time is more than 0.5 seconds.
end Turns off drive (augerHalt())
interrupted Same as end();

3.7.2.2 AugerUpCommand moves the auger in the up direction as long as it runs.

requires AugerSubsystem
initialization None.
execute Uses the augerUp method to move the frisbees.
isDone Runs until interrupted.
end Turns off drive augerHalt()
interrupted Same as end();

3.7.2.3 AugerDownCommand moves the auger in the down direction as long as it runs.

requires AugerSubsystem
initialization None.
execute Uses the augerDown method to move the frisbees.
isDone Runs until interrupted.
end Turns off drive augerHalt()
interrupted Same as end();

3.7.3 Public Methods

```
public boolean readAugerLimitSwitch()
reads the limit switch at the bottom of the auger.
public boolean isAugerNeutral()
tells if the auger is in the neutral position.
public void augerUp()
turn the auger motor so that frisbees move to the top.
public void augerDown()
turn the auger motor so that frisbees move to the bottom.
public void augerHalt()
turn the auger motor off.
```

3.7.4 Internal Methods

```
double readAugerEncoder()
reads the auger position in degrees. I'll bet that the code to update the dashboard and isAugerNeutral() use this.
```

3.8 HarvesterSubsystem

3.8.1 Actuators, Controllers, and Sensors

WheelsController is the Victor controller for the harvester wheel motors.

BeltController is the Spike for the belt motor.

3.8.2 Commands

3.8.2.1 HarvesterRunCommand keeps the harvester and belt motors at the proper speed.

requires HarvesterSubsystem
initialization None.
execute *needs work*
isDone Runs until interrupted.
end *needs work*
interrupted Same as end();

3.8.2.2 HarvesterWheelsInManualCommand runs while the control panel HarvesterWheel override is set to move the wheels inward.

requires None.
initialization None.
execute *needs work*
isDone Runs until interrupted.
end *needs work*
interrupted Same as end();

3.8.2.3 HarvesterWheelsOutManualCommand runs while the control panel HarvesterWheel override is set to move the wheels outward.

requires None.
initialization None.
execute *needs work*
isDone Runs until interrupted.
end *needs work*
interrupted Same as end();

3.8.2.4 HarvesterBeltInManualCommand runs while the control panel Belt override is set to move the belt inward.

requires None.
initialization None.
execute *needs work*
isDone Runs until interrupted.
end *needs work*
interrupted Same as end();

3.8.2.5 HarvesterBeltOutManualCommand runs while the control panel Belt override is set to move the belt outward.

requires None.
initialization None.
execute *needs work*
isDone Runs until interrupted.
end *needs work*
interrupted Same as end();

3.8.2.6 HarvesterToggleCommand toggles whether the harvester is on or off.

requires None.
initialization None.
execute *needs work*
isDone Runs once.
end *needs work*

interrupted Same as end();

3.8.3 Public Methods

There is a HarvesterDirection Java class that represents the desired direction for the Harvester components. A HarvesterDirection can have three values HarvesterDirection.IN, HarvesterDirection.OUT, HarvesterDirection.OFF.

public void setOnOffState(boolean b)

saves the current on/off state of the joystick button.

public boolean getOnOffState()

gets the current on/off state of the joystick button.

public void toggleOnOffState()

toggles the current on/off state.

public void setBeltDirection (HarvesterDirection direction)

saves the desired manual belt direction.

public HarvesterDirection getBeltDirection ()

gets the desired manual belt direction.

public void setWheelDirection (HarvesterDirection direction)

saves the desired harvester wheel direction.

public HarvesterDirection getWheelDirection ()

gets the desired manual wheel direction.

public void wheelsOff()

turns the wheel motors off.

public void wheelsIn()

runs the wheel motors so that they bring disks in.

public void wheelsOut()

runs the wheel motors so that they spew disks out.

public void beltOff()

turns the belt motor off.

public void beltIn()

runs the belt motor so that it brings disks in.

public void beltOut()

runs the belt motor so that it spews disks out.

3.9 ShooterTiltSubsystem

3.9.1 Actuators, Controllers, and Sensors

ShooterTiltController is the Victor controller for the shooter tilt motor.

ShooterTiltSensor is the analog input for the shooter tilt potentiometer.

ShooterTiltPID is the PID controller for the shooter tilt.

3.9.2 Commands

3.9.2.1 ShooterTiltBumpAngleUpCommand bumps the desired shooter angle up.

requires None.

initialization None.

execute *needs work*

isDone Runs once.

end *needs work*

interrupted Same as end();

3.9.2.2 ShooterTiltBumpAngleDownCommand bumps the desired shooter angle down.

requires None.
initialization None.
execute *needs work*
isDone Runs once.
end *needs work*
interrupted Same as end();

3.9.2.3 ShooterTiltEnableCommand enables the shooter tilt.

requires None.
initialization None.
execute *needs work*
isDone Runs once.
end *needs work*
interrupted Same as end();

3.9.2.4 ShooterTiltToggleCommand toggles the enabled/disabled state of the shooter tilt.

requires None.
initialization None.
execute *needs work*
isDone Runs once.
end *needs work*
interrupted Same as end();

3.9.2.5 ShooterTiltDisableCommand disables the shooter tilt.

requires None.
initialization None.
execute *needs work*
isDone Runs once.
end *needs work*
interrupted Same as end();

3.9.3 Public Methods

This needs work.

```

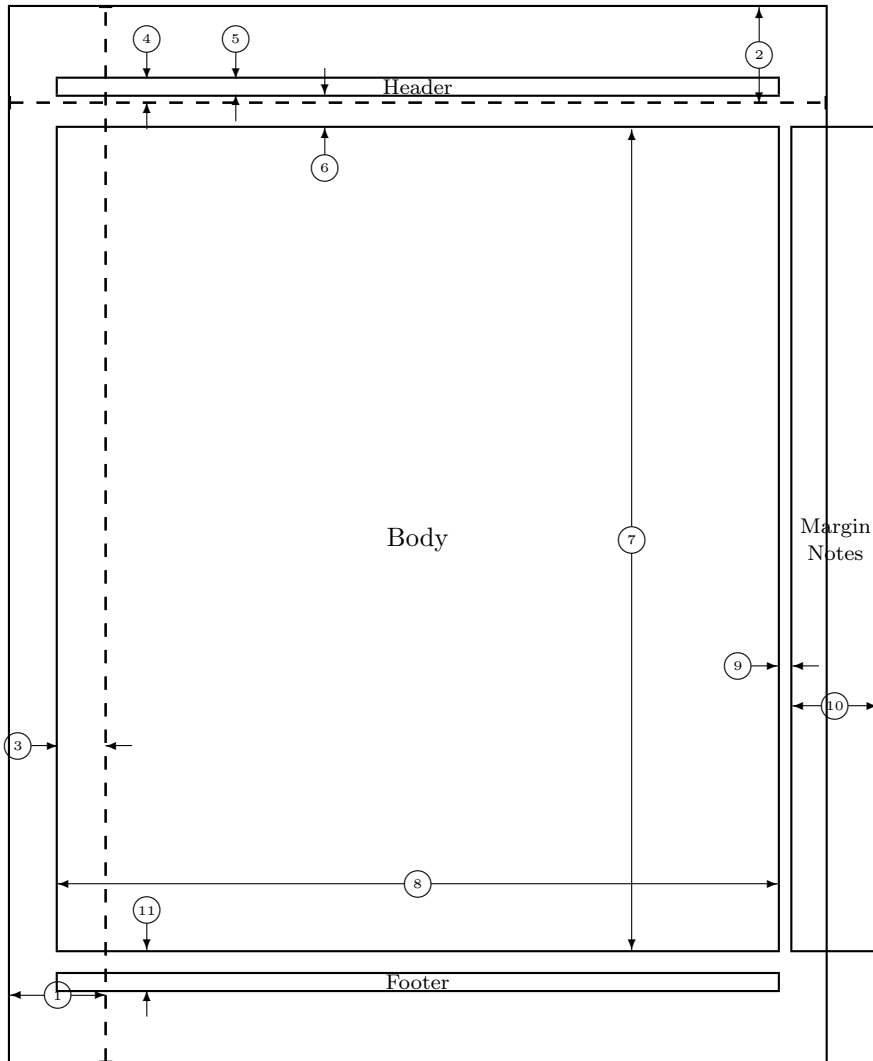
public void enableShooterTilt()
enables the shooter tilt.
public void disableShooterTilt()
disables the shooter tilt.
public void toggleShooterTilt()
toggles the shooter tilt.
public void setDesiredShooterTiltAngle(double degrees)
set (saves) the desired shooter tilt angle.
public double getDesiredShooterTiltAngle()
gets the saved shooter tilt angle.
public double getCurrentShooterTiltAngle()
reads the current shooter tilt angle.
  
```

3.10 Operator Interface

<i>Name</i>	Joystick	Button Number	Command	When to Run
LiftExtend	Driver Joystick	6	LiftExtendCommand	whileHeld
LiftRetract	Driver Joystick	7	LiftRetractCommand	whileHeld
DriveTurboEnable	Driver Joystick	3	(none)	(none)
DriveDirectionToggle	Driver Joystick	8	(none)	(none)
HarvesterOnOff	Driver Joystick	1	HarvesterToggleCommand	whenPressed
ShooterOn	Driver Joystick	?	ShooterOnCommand	whileHeld
FlipperButton2	Control Panel	1	FlipperFlipCommand	whenPressed
FlipperForward	Control Panel	8	FlipperForwardCommand	whileHeld
FlipperBackward	Control Panel	7?	FlipperBackwardCommand	whileHeld
AugerUp	Control Panel	10	AugerUpCommand	whileHeld
AugerDown	Control Panel	9	AugerDownCommand	whileHeld
HarvesterIn	Control Panel	6	HarvesterWheelsInManualCommand	whileHeld
HarvesterOutt	Control Panel	5	HarvesterWheelsOutManualCommand	whileHeld
BeltIn	Control Panel	4	HarvesterBeltInManualCommand	whileHeld
BeltOut	Control Panel	3	HarvesterBeltOutManualCommand	whileHeld
FlipperButton	Shooter Joystick	1	FlipperFlipCommand	whenPressed
ShooterOn	Shooter Joystick	4	ShooterOnCommand	whileHeld
ShooterFaster	Driver Joystick	3	ShooterFasterCommand	whenPressed
ShooterSlower	Driver Joystick	2	ShooterSlowerCommand	whenPressed
AugerIndex	Shooter Joystick	5	AugerIndexCommand	whenPressed
ShooterTiltOff	Shooter Joystick	8	ShooterTiltDisableCommand	whenPressed
ShooterTiltUp	Shooter Joystick	7	ShooterTiltBumpAngleUpCommand	whenPressed
ShooterTiltDown	Shooter Joystick	1(!)	ShooterTiltBumpAngleDownCommand	whenPressed

A RobotMode.java

```
public class RobotMode {  
    private String name;  
    public RobotMode (String n) {  
        name = n;  
    }  
    public String toString() {  
        return name;  
    }  
    public static final RobotMode DISABLED = new RobotMode("DISABLED");  
    public static final RobotMode AUTONOMOUS = new RobotMode("AUTONOMOUS");  
    public static final RobotMode TELEOP = new RobotMode("TELEOP");  
    public static final RobotMode TEST = new RobotMode("TEST");  
}
```

- | | | | |
|----|------------------------|----|----------------------------------|
| 1 | one inch + \hoffset | 2 | one inch + \voffset |
| 3 | \oddsidemargin = -36pt | 4 | \topmargin = -18pt |
| 5 | \headheight = 12pt | 6 | \headsep = 25pt |
| 7 | \textheight = 619pt | 8 | \textwidth = 542pt |
| 9 | \marginparsep = 11pt | 10 | \marginparwidth = 65pt |
| 11 | \footskip = 30pt | | \marginparpush = 5pt (not shown) |
| | \hoffset = 0pt | | \voffset = 0pt |
| | \paperwidth = 614pt | | \paperheight = 794pt |