Progressive Report for SmartPitcher

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1. Introduction

A pitching machine is diversely used in many sport teams to improve efficiency of athlete's training output. The recent advancements in technology have helped athletes improve the way that they train dramatically. The SmartPitcher by Auto Sports is an innovative pitching machine that will track an athlete's movement and provide feedback by firing the ball to the exact location. The Auto Sports team intend to demonstrate the final prototype on April 19th, 2016 as a beneficial requirement for the public audience, and the stakeholders. The prototype is designed with three main areas: hardware, firmware, and software. In addition, the design was centered on safety, usability, and cost-effectiveness during our development phase of the prototype.

2. Schedule

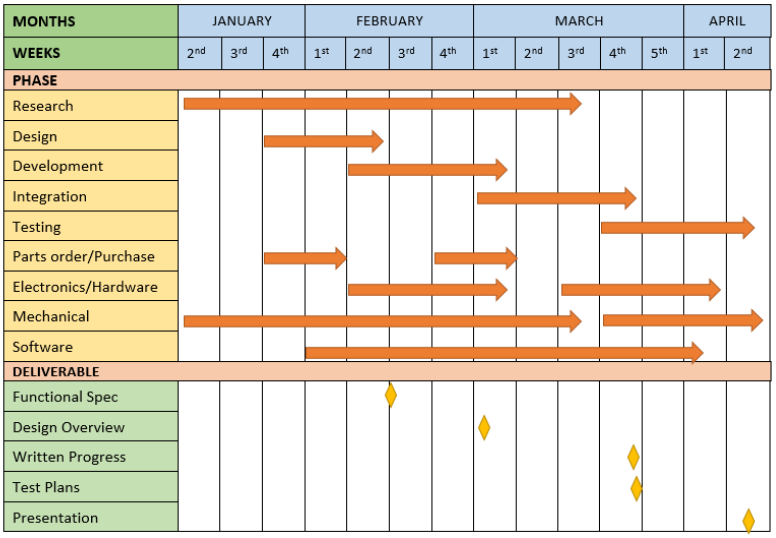

Figure 1: Timeline Schedule throughout the Term

Figure 1 represents the overall plan for the development of SmartPitcher. Scrum framework was applied to an original plan, where tasks were focused on fulfilling prioritized deliverables forfinal prototype every two weeks. However, we faced some set-backs and delays as some electronic parts were hard to obtain. Fortunately, most of the core components arrived at reasonable times, as a result both Development and Integration Phases were delayed by one week. Since we were set back a week behind we decided to save time by combining last week of Development Phase with the Testing phase. For instance, all the software testing were executed with similar parts which wereprimilary included in the microcontroller kit. As a result when the parts arrived, we already have completed software testing as our codes for the microcontroller. Moreover, we were successful at integrating with the software. Even though we are ahead of schedule in software aspect, we are still behind in assembling all the components together. This is also partly because each part of the SmartPitcher wasdeveloped separately.In brief, the project is currently about a week behind from our proposed schedule. The details of current progress is discussed in Section 4, and any minor corrections are discussed in Section 5.

3. Financial

Equipment List	Estimated Cost	Used Components	Expenditure
Microprocessor	$150	OSEPP™ 201 Arduino Basic Starter Kit	$100.00
Motor x2	$160	Arduino UNO R3 MEGA 2560	$15.00
Motion Sensor	$15	USB 2.0 A-B M/M 6 ft cable	$9.86
Touch Switch Sensor	$20	RS-775 Motor 7000rpm 12V 76.13oz-in x2	$84.56 ($35.52 for shipping)
Infrared Sensor x2	$30	Universal Mounting Hub – 5mm Aluminum	$8.50
Ranger Sensor	$90	Pololu Motor Driver Shield VNH5019	$60.00
Motion Tracker	$70	Battery, Rechargeable SLA, Lead Acid, 12V, 4Ah	$16.95
Motor Controller x2	$80	MaxPower 335070 7-Inch Plastic Wheel Diamond Tread x2	$64.48 ($36.50 for shipping)
Wheel	$10	Roborealm Software	$70.54
Others	$100	Webcam	$20.00
		Analog Servo Motor	$31.00
		Bluetooth Shield v2 (for Arduino)	$42.24
		LEGO Red Housing 2 x 15 x 3m F/gear Rack	$3.02
		LEGO Dark Stone Gray Gear with 24 Teeth	$0.45
		LEGO Dark Stone Gray Rack 14 x 2m with groove	$3.46 ($8.83 for shipping)
		Power Functions XL-Motor	$11.49
		Power Functions Battery Box	$8.49
		DRV8833 Dual Motor Driver Carrier	$26.23 ($19.71 for shipping)
		Others (Rotation Platform + Ball)	$30.00
		Gear Motor 12V 500 RPM x2	$31.50
		9.7:1 Metal Gearmotor 25Dx48L mm HP 12V x2	$89.85 ($45.95 for shipping
Total Cost	$725	Total Cost	$736.45 (-$11.45)
		Funding Sources	
		ESSEF Funding	$415.00

Table 1: Comparison of Project Cost Breakdown & Actual SmartPitcher Cash Flow

The actual total cost for the SmartPitcher prototype development already exceeded the budget supported by the Engineering Student Society Endowment Fund (ESSEF). Moreover, it surpassed our estimated cost by $11.45. Even though our assumption towards the number of essential components was not too various during the proposal, our team realized that wide variety of hardware/mechanical components would be necessary for the successful development, which resulted in spending more budgets. The increase in total cost was inevitable in order for us to become accustomed to the use of motors. Furthermore, the top priority shipping, which costs the most, was also essential due to the time constraint and limited local places to purchase the components.

4. Progress

4.1 Hardware

The progress of the development and electronics hardware components has been going smooth. We are expecting to have couple more days on integration process to enhance the accuracy on measurements. The majority of components has been built, and the testing is in the progress. We have done researching, planning, and designing. However, we still have minor problems on parts/material acquisition and tests/measurements issues on a particular system. The final testing is required to observe any issues when all the components are assembled together.

4.1.1 Motor Speed Control System

The motor speed control system using the motor shield has been tested that we were able to synchronize the dual motors through the power supplier, one rotating in clockwise and the other one rotating in counter-clockwise with the same speed, to engulf the ball into the spinning wheels. We are expecting to

spend few more days on integration where we want to have suitable wheels with required friction and perfect size for firing tennis ball on our demonstration. We have tested with Ultrasonic and detected a major problem on distance stability.

4.1.2 Motion Tracking System

The motion tracking system has been completed and tested using the third party vision application RoboRealm, Servo motor, Webcam, and Arduino. We have verified when the user gets off the boundary which is set to 20 pixels from the center, the servo constrained new values and moved the webcam to have the user in the center. It also meets the requirements for the torque, rotating speed, color-code object identification, and it is ready to be integrated into our final assembly of the pitching machine.

4.1.3 Ball Loading (Bluetooth Trigger) System

We have reached most of the important milestones in creating a functioning ball loading mechanism that gets integrated with the launching and tracking system to first locate the player and then launch the ball when is the player is ready. We have successfully sent a trigger signal to our loading mechanism using the chosen Bluetooth system and Android App. The effective range of Bluetooth has been achieved and it is fully tested, debugged and ready to use. We observed when the user touches the keypad on the smartphone interface, the stepper motor successfully gets the signal from the Bluetooth system and the shaft makes a full clockwise rotation which results in rotating the gear attached to it by an axle.

4.2 Software

Overall, the development and the integration progresses on software are behind. However, the software being used for motion tracking system and ball loading system are completed and tested. The software being used for motor speed control system when detecting the distance between the machine and the user is still needed to be integrated. The final stage of testing on the entire assembled pitching machine will be started in the week of April 4th, 2016.

5. Remediation

As most of the software and firmware areas are almost complete, the workdays have been allocated towards the final assembly of all the components, and finding an alternative solution to what was criticized in the design specification document. The criticisms involve possibly changing the current microcontroller to a higher-end microcontroller, and changing couple of electronic components such as ultrasonic sensor to satisfy design needs. In addition if we have extra time, we are planning to add different operating modes to benefit the user with variety of features of the machine.

6. Conclusion

Currently, the actual development of the “Motor Speed Control” section within the SmartPitcher is few workdays behind the schedule. After the remaining components, 7-inch plastic wheel, are successfully delivered by March 30th of 2016, the testing of DC motors and wheels, during the integration with Arduino, are going to be conducted immediately. Even though the “Motor Speed Control” part of the SmartPitcher is bit behind the schedule, the “Motion Tracking System” and “Ball loading mechanism” parts have been completed. Although a few changes within the SmartPitcher were made after reviewing the evaluated design specifications, our project is still on track to meet proof-of-concept prototype.