Design of Wireless Triangulation Mechanism for Distance Measurement Automation

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Extended Abstract

In 2017, the SUNY Jefferson Student Society of Engineers competed in the Clayton, NY Punkin Chunkin competition. The original method for calculating distances consisted of a mechanical angle measurement device mounted to a tripod. Using right-angle trigonometry, the user would determine straight-line distance for the projectile and have runners relay to score keepers. While this method was fairly accurate, deviations would introduce error, particularly at larger distances, and proved extremely inefficient for a time-sensitive competition. The Clayton Chamber of Commerce asked the SUNY Jefferson team to design a more efficient and automated system for use in future competitions.

A system was designed using two Arduino boards, each with a 9 degree-of-freedom (DOF) sensor to measure angle to within thousandth of a degree. These microprocessors were then enclosed in a 3D printed case of ABS plastic, mounted to a tripod with a sight, and placed at both edges of the firing line. Calibration of the system requires an initial lock to the other unit and powering on of the system, thus establishing the zero-angle reference point for the sensor. Upon any trebuchet firing a projectile, users aim at the impact point. Using a 2.4 GHz wireless transmitter fitted to each Arduino board, the angle is transmitted to the wireless receiver at the score station computer. The system makes use of a Raspberry Pi™ microprocessor to record both angles, calculate the straight-line distance of the projectile using triangulation, and display distance to the score keeper's laptop.

Setup and calculations performed by the designed data acquisition system, the layout and site plan for the competition, and our team's experiences will be shared.