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EECS 372

**Progress Report 3**

 Many details of real-life penalty kicks have been implemented. Every patch in my model is a unit cube, in feet. Therefore the goalkeeper and the kicker (who does not have any effect on the model) are 6 patches in size, and the ball is .75 patches in size; a soccer ball is around .75 feet in diameter.

 A ball misses, but is not saved, when the ball flies away from the goal. To simulate this, the upper limit on the horizontal travel of the ball is set at 12.5 feet towards both sides. The upper limit on the vertical travel of the ball is set at 8.3 feet. A goal is 24 feet wide – and therefore extends from its center 12 feet towards both sides – and 8 feet tall. On average\* the ball seems to miss about 4% of the time, reflecting the statistic that penalty kicks are missed completely around 5% of the time. These upper limits slightly increase when the ball is not kicked towards the kicker’s natural direction.

A save is made when the ball is in distance 2 away from the body of the goalkeeper. This seemed reasonable, and after experiments\* it seemed that when the goalkeeper and the ball go toward the same direction, the ball is saved around 30% of the time, reflecting the statistic that penalty kicks are scored around 69% of the time when the kicker and the keeper choose the same direction.

The ball travels four times faster than a player can travel. This speed decreases when the ball is not kicked towards the kicker’s natural direction.

A soccer ball, on average, takes 0.3 seconds to travel the distance of a penalty kick, whereas a goalkeeper’s reaction time to the direction of the ball is around 0.22 seconds on average. Taking this into account, when the soccer ball has traveled 26 feet from its origin, if the goalkeeper is already travelling in the same direction as the ball, the keeper reacts to the ball and faces towards it. When this happens his speed of movement increases and he makes the last stretch for the ball.

\*Tested through BehaviorSpace.