BALL RETURN PUTTING MAT WITH SCOREKEEPER

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1 Introduction

1.1 Objective

Golf is a sport that requires a lot of time and practice in order to improve. However, it is a very weather dependent sport and many players are not able to practice during the winter months or during rainy days without spending a lot of money to go to indoor practice facilities or to purchase practice mats for their homes. There are some cheaper practice mats available, especially for putting, but they do not return the ball to the player or allow you to keep track of made putts.

Our goal is to build a low-cost putting mat that will allow players to practice indoors. This putting mat will include a mechanism that returns made putts to the user, allowing for more efficient practice time. It will also utilize a control circuit that will operate the return mechanism as well as keep count of all made putts by the user. This circuit will transmit a signal to a hex display via bluetooth every time a putt is made. This hex display will keep track of the number of putts made, as well as include a timer for competitive purposes.

1.2 Background

In sports, there are a lot of advancements being made with analytics and statistics to help players to track progress and continue to improve. Our device would allow a user to practice and track progress in the number of putts made over a given time span or to practice through competition. Our putting mat would allow users to do just that, as there is no putting mat available on the market that will track the number of putts made and return the ball to the user.

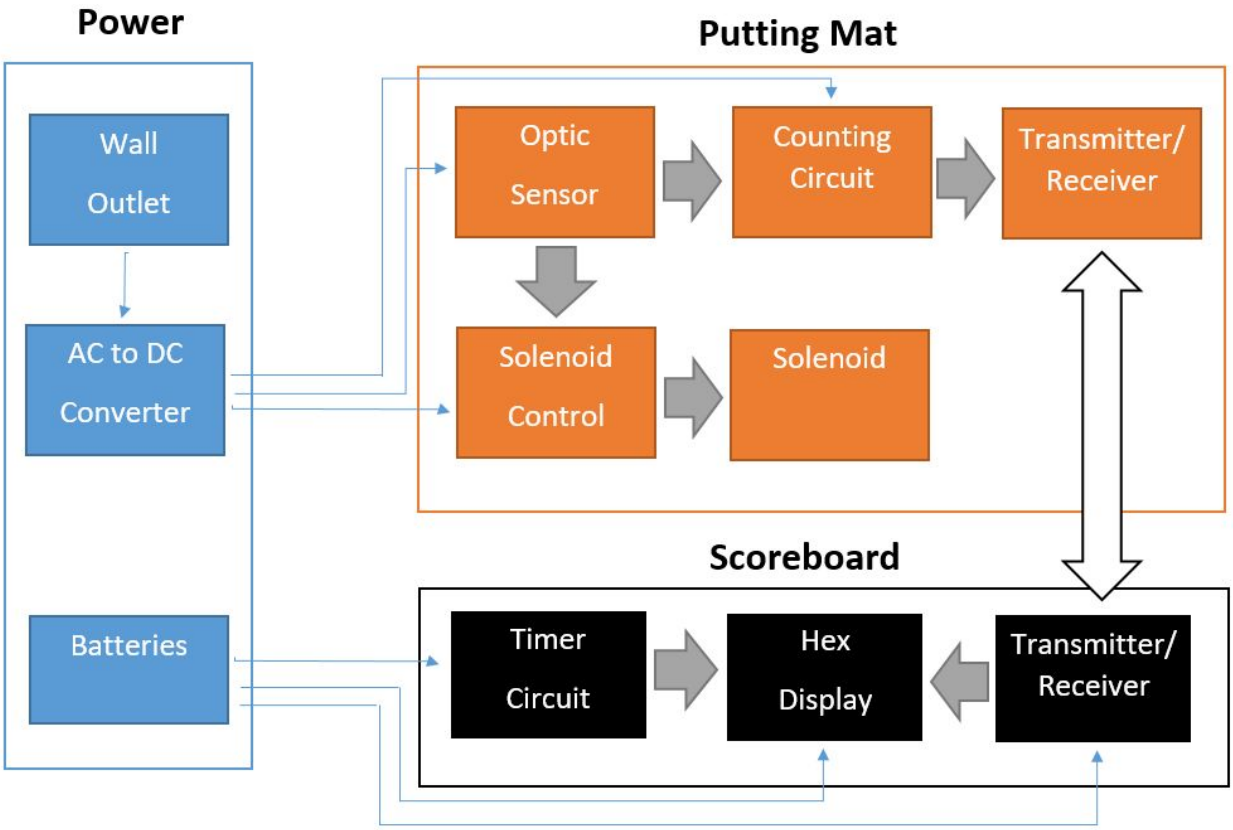
1.3 High Level Requirements

- The scoreboard should increment whenever a ball has entered the hole.
- The scoreboard should be able to take an input from a dial that will count down and keep an accurate time for each game.
- The return mechanism should safely return a made putt to the user after a slight delay.

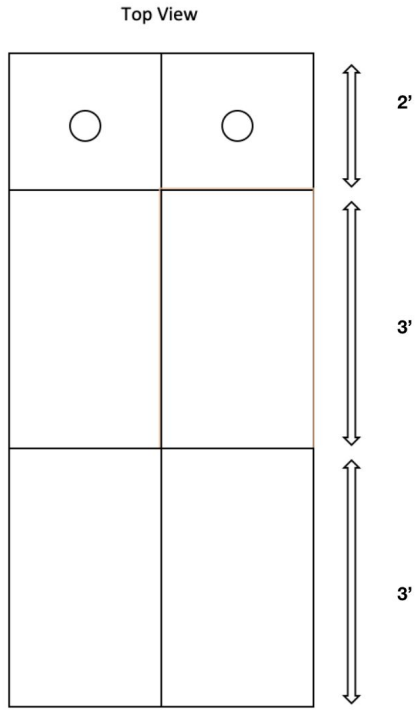
2 Design

Living in the midwest, it is hard to practice or compete in golf during the winter. One of the most important parts of a player's game is putting so the ability to practice indoors during the winter is important in improving one's game. On the market there are lots of indoor putting mats including some that will return the ball to you, however there isn't a mat that keeps score and allows to compete against a friend.

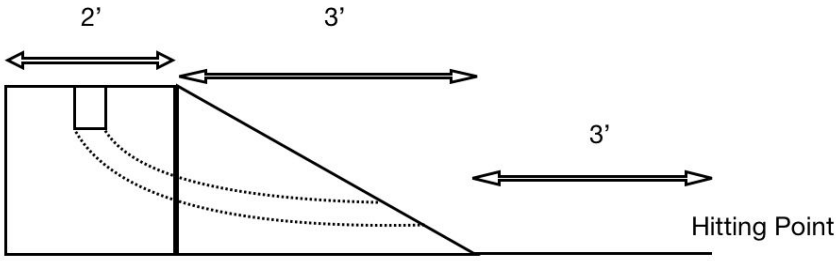
2.1 Block Diagram



2.2 Physical Design



Side View



2.3 Power Supply

The Putting Mat and Scoreboard will be powered by too separate sources. The Putting Mat will be powered by a wall plug and the Scoreboard will be powered by a battery pack.

2.3.1 Wall Outlet

A cord will allow for the user to plug the device into a standard 120V AC wall outlet.

2.3.2 AC/DC Converter

The 120V AC will need to be converted to 5V DC to be used on our counting circuit and control circuit and to power our pressure sensor, solenoid, and transmitter

2.3.3 Batteries

This pack will use a 9V battery to power the circuits and receiver.

2.4 Putting Mat

We will use the space underneath the mat to house our circuitry that will allow a made to be counted and transmitted and then return the ball to the user.

2.4.1 Optic Sensor

This will sit inside the edge of the hole, when the ball is detected it will output a logical high that go to the solenoid control circuit and the counting circuit. We will use an infrared optical sensor.

2.4.2 Counting Circuit

This circuit will allow us to keep track of each player’s score. This will be implemented using logic gates and flip-flops and will create an 8 bit sequence for the player’s score. The circuit will also take an input from the receiver/transmitter that will allow reset of the both scores from pushing a button on the scoreboard.

2.4.3 Transmitter/Receiver

Transmitter in putting mat will send 16 bits to the scoreboard and will need to receive a one bit signal to tell when to reset the counter. We will be using the RN-41 Bluetooth module to accomplish this.

2.4.4 Solenoid Control

This circuit will be design to have the solenoid extended to block the ball from initially returning. Once the sensor has seen the ball, it will cause the solenoid to retract and drop the ball allowing it to return.

2.4.5 Solenoid

The solenoid will need to extend to cover the 4.25” hole to prevent the ball from passing. This should be powered on a 5V supply to prevent the need to convert from our supply.

2.5 Scoreboard

2.5.1 Timer Circuit

This circuit will count down from a time that is set by the user, the time can be set using a push button. An arduino will be used to set the initial time to four IC4026 ic’s that will be used to do the actual counting. This count will be displayed on a seperate hex display.

2.5.2 Hex Display

This will consist of seven hex displays and will require seven hex drivers. Four of these will be used to display the score of the users, two per user. The other three will be used to display the time of the counter.

2.5.3 Transmitter/Receiver

This will need to receive the 16 bits of user scores and transmit a one bit signal when the scores need to be reset.

2.6 Tolerance Analysis

3 Cost and Schedule

3.1 Cost Analysis

3.2 Schedule

4 Ethics and Safety

In accordance with the IEEE Code of Ethics, #1, we are responsible for making sure our project is safe for the public to use and that we disclose any potential factors that might endanger the public [1]. The main concern for safety in our project is the ball return mechanism. We do not want to design this in such a way that the user can be harmed by the ball while it is being returned. Our design addresses this concern by returning the ball under the putting surface and at a slow speed.

The main safety concern is our 120V AC/DC converter. At the moment, we are unsure how much power this will need to pull which means there could be dangers in overheating of parts in this converter. Heat syncs can be used as well as housing the converter outside of the mat. There is also a potential hazard in using this much voltage.

5 Citations

[1] IEEE.org, "IEEE - IEEE Code of Ethics", 2019. [Online]. Available: http://www.ieee.org/about/corporate/governance/p7-8.html. [Accessed: 7- Feb- 2019].