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Camera/Webcam Design

Phone vs. Webcam

For the autonomous phase, our team wanted to use TensorFlow in conjunction with a to identify the Skystone. The camera we wanted to use was either the rear-facing camera on the back of our phone, the Moto E4, or a webcam we had, the Logitech C920 Pro. We decided to go with the webcam, mainly because of how much easier it was going to be to position and mount. Because the phone has to be taken off and on so many times while we revise the programs, we could have never gotten the positioning of the phone to be the same, thus changing the view of the camera each time.

Even though both the webcam and the phone have the same resolution (1920x1080), the webcam has a larger frame size than the phone. Frame size of a camera is how large the sensor is. So naturally, if a camera has a larger frame size, it can see more without zooming, which would decrease the quality of the picture.

Placing the Camera - Webcam

When we considered the possibilities when placing the camera, which is the webcam, we realized that the best choice would be to place it forward facing. This way, our robot would not have to turn to drive to the target, wasting valuable time. After deciding this, we almost arbitrarily chose which side on the front to put it on -- either left or right. We chose the right side. For the . red Side, the blocks are left at the starting position. The opposite is true for the blue side.

Elevation and Positioning

The lower a camera is, the less it is. By that logic, the higher up it is, the more it is. In this case, we wanted our webcame to be as high up as possible without making our robot too tall. Our webcam is 8.5" off the ground, providing clearance over the stones, which are only 4" tall. The webcam also has two joints: one in the middle allowing it to be position, and another at the actual camera allowing it to be angled properly. With a combination of the two, we found (through a process of trial and error) an angle of 84.6° worked the best. In terms of position, we found that a distance of 22" from the stones is the "Goldilocks" zone. With these optimization parameters (84.6° and 22" away), we found that if the camera is at the wrong angle or distance, the camera may miss the

target or not be able to detect it. This means that the angle has to be highly controlled and stabilized.

Webcam Mount

In stabilizing the webcam, we realized that the mount or brace had to be lightweight and small enough that it would not be in the frame of the camera. We decided to use the same material that we used for the capstone: foamboard. It is easy to work with and very lightweight. The webcam is 1.625" wide, and 1.5" tall. The brace had to fit these specifications while supporting the angle of 84.6° (see Fig. 1)

Fig. 1: