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HOWARD UNIVERSITY

Terminator

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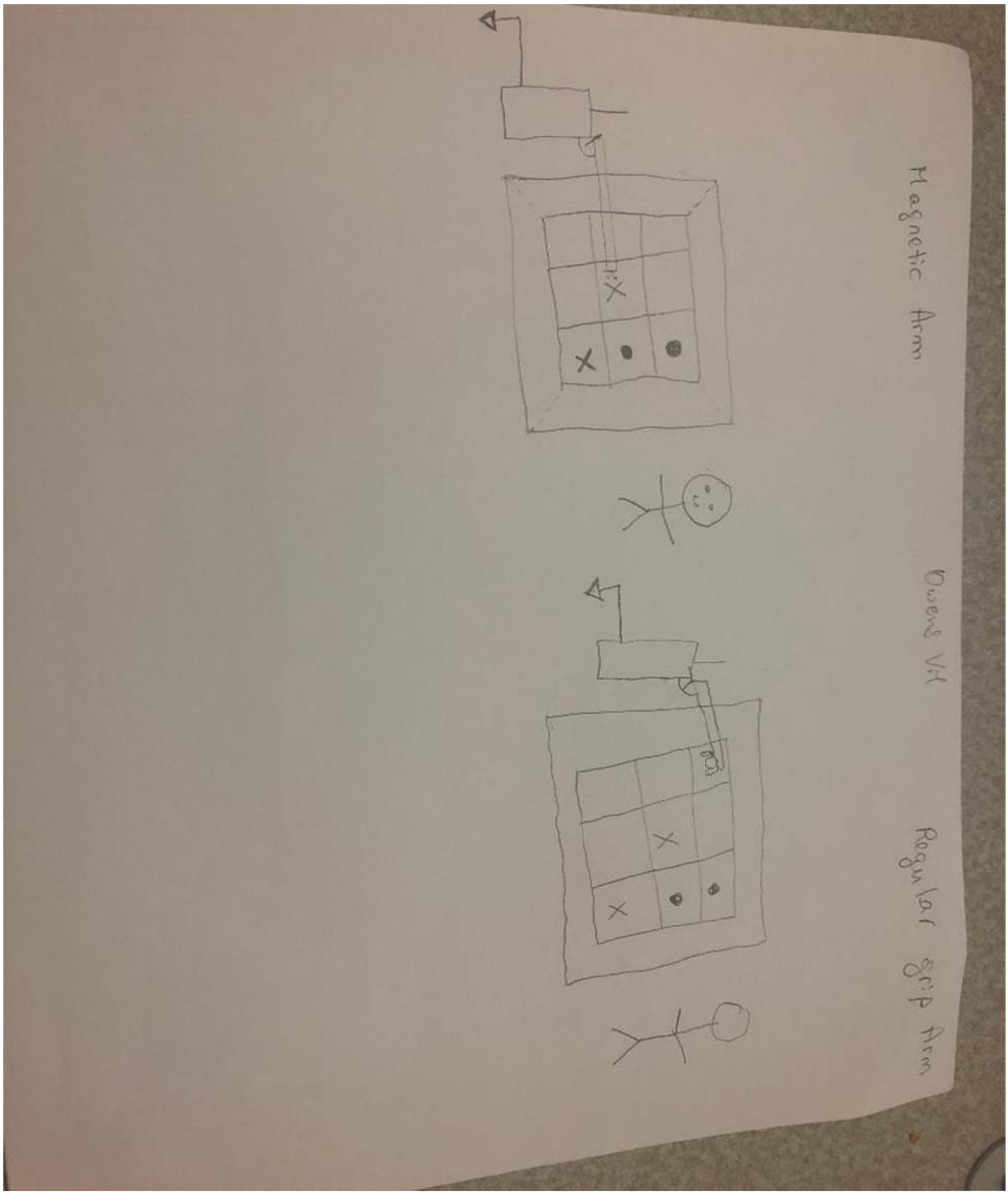
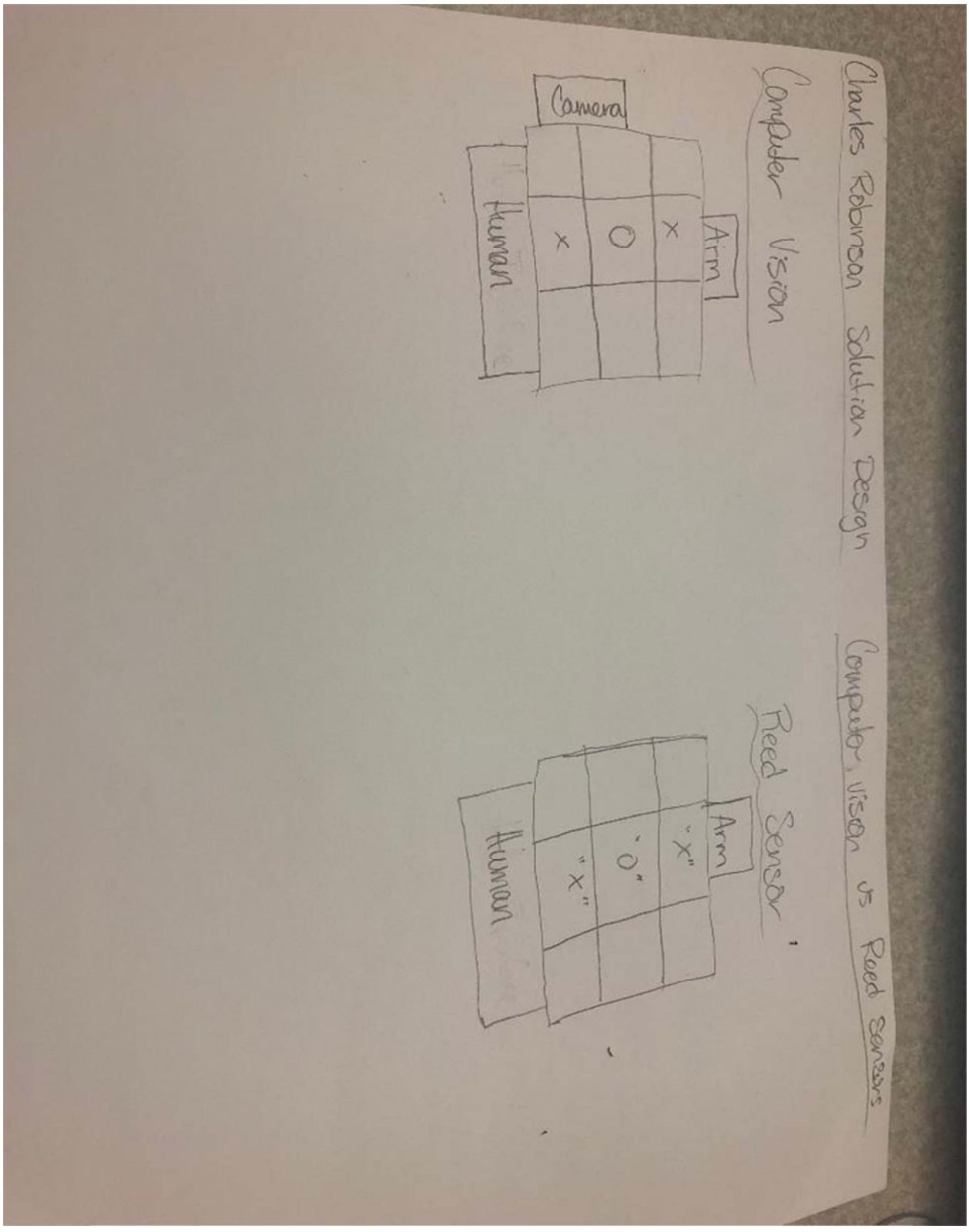
11/5/18

In designing the Terminator, each EE group member brought forward an original drawing of how they think the system should be designed. Of these designs, the team decided to narrow down selection to just two designs for which the Terminator may be based upon. From these top two designs, the group weighed their options using a design matrix in order to tell, by scores, which design would be followed. Every drawing and idea had its own pros and cons, so, instead of just choosing one single design, the team found ways to incorporate ideas and concepts from each other's designs to make one final design.

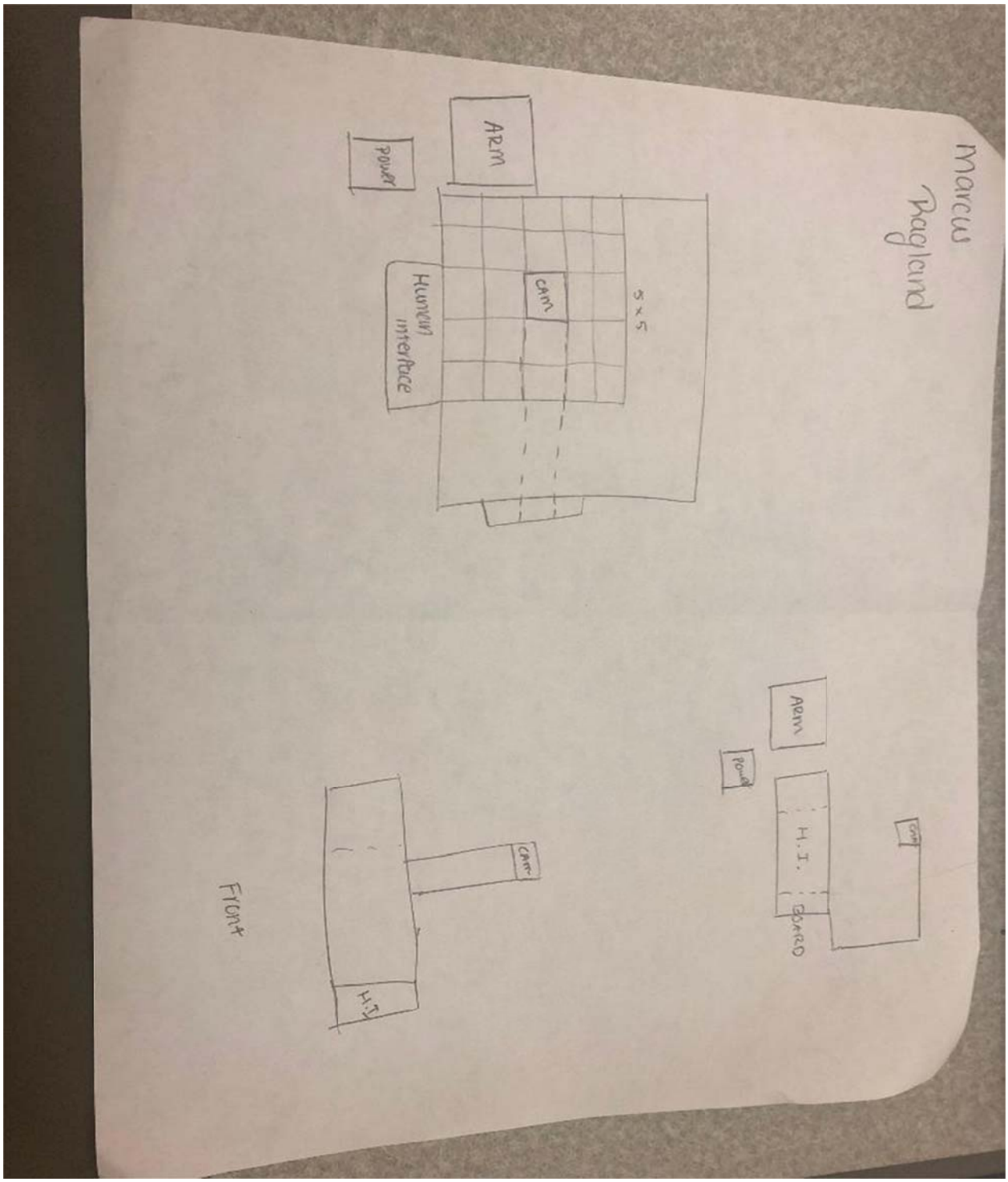
Owens Vil's Solution Design



Charles Robinson's Solution Design



Marcus Ragland's Solution Design



Top 2 Design Descriptions

Marcus Description

In this design, the power supply provides power to the initial system in order to power the robot arm, camera, driver-vehicle interface, and raspberry pi. The raspberry pi offers the algorithm to the system for playing tic tac toe. The user interacts with the driver-vehicle interface to decide who goes first, the human or robot arm. This information is taken in by the raspberry pi and depending on who is chosen to go first, the system allows for them to begin the game. The algorithm then continues to allow the player to play against the robot arm in a competitive game of tic tac toe, where the robot arm uses a grip method to physically pick-up and drop its pieces to the desired position in the game. After each piece is placed, the camera sees where the piece has been placed and signifies the owner of that space on the board. When three of the same pieces have been recognized in a horizontal, diagonal, or vertical fashion, the camera recognizes this, and the system denounces the winner. If players have filled the board with no recognition of three-in-a-row, the system calls a tie.

Pros	Cons
Simple method of moving pieces	Grip may drop pieces prematurely
Enables greater control over individual pieces	Requires more power to lift pieces
Basic algorithm readily available on open software for easy implementation	Difficulties processing images

Charles Description

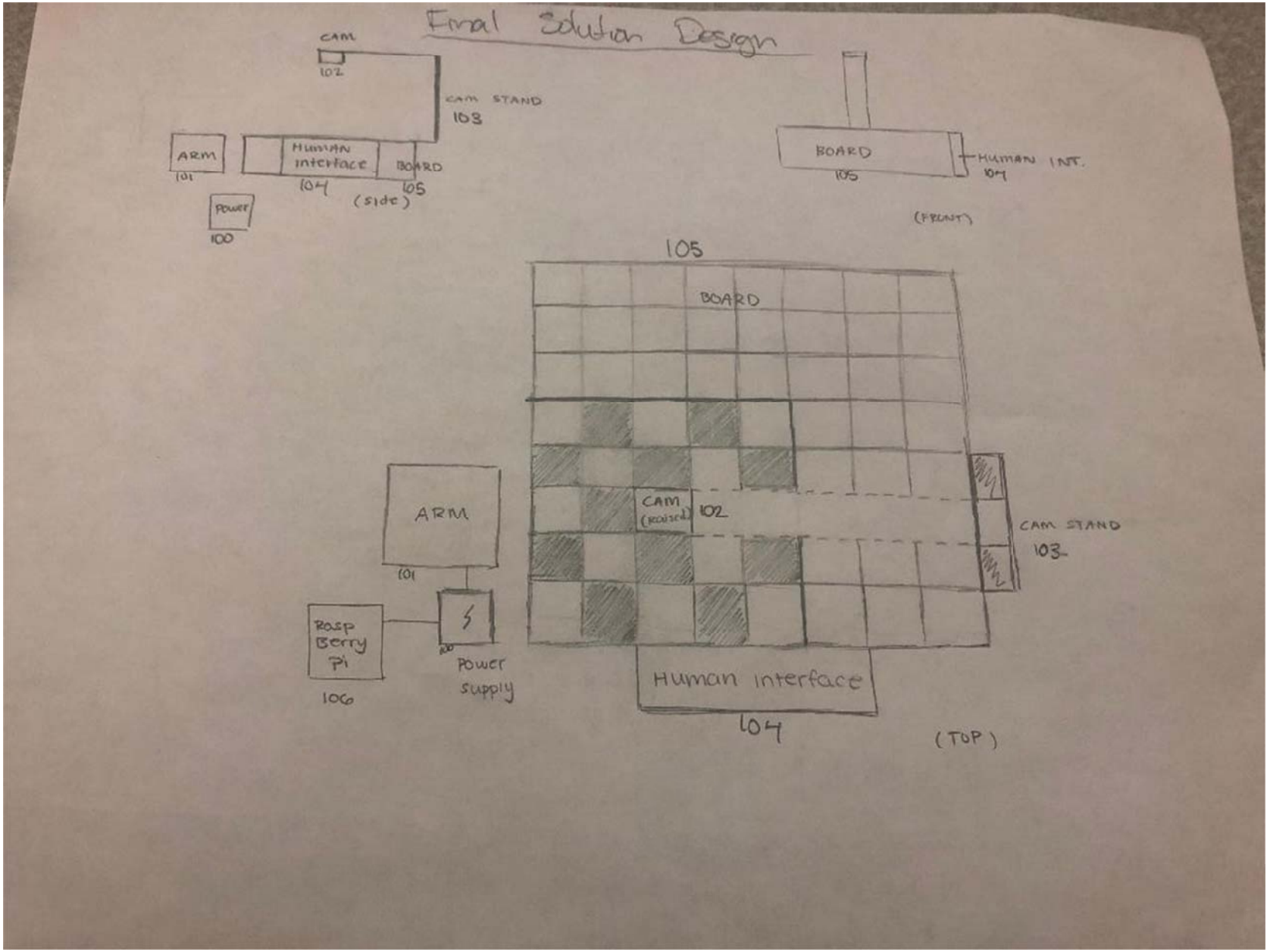
Throughout the process of deciding which design is best, the team has been considering if using computer vision or reed sensors would be more effective. In the computer vision description, an arduino camera is processing the image of the game board and provides an appropriate output to the rest of the system signaling the correct algorithm. In the reed sensors description, sensors are distributed throughout the board to detect if a game cell is empty, or filled. The sensors will respond to the input from the physical environment, the placement of game pieces, and transmit electronically an output to begin the correct tic tac toe algorithm. The arm, then places the correct game piece in the right situational location.

Pros	Cons
Easy detection if spaced is used through sensors	Can’t determine if marked with “x” or “o”
Simple method of moving pieces	Requires more power for lifting pieces and powering sensors
Simpler communication to code when cell is filled/empty	Grip may drop pieces prematurely
	Outside objects may confuse sensors if on board

Decision Matrix For Top Design Selection

	Weight	Charles's Design	Score	Agg. Score	Marcus's Design	Score	Agg. Score
Functionality	**5**	**Uses sensors to and grip method**	**3**	**15**	**Uses computer vision and grip method**	**3**	**15**
Power	**4**	**More components to be powered**	**4**	**16**	**Fewer components to be powered**	**5**	**20**
Weight	**3**	**< 3 kg**	**4**	**12**	**< 3 kg**	**4**	**12**
Convenience	**2**	**At home edit**	**3**	**6**	**At home edit**	**3**	**6**
Connectivity	**1**	**Wired**	**5**	**5**	**Wired**	**5**	**5**
Total				**54**			**58**

Top Design Solution


Final Solution Design
CAM
102
CAM STAND
103
ARM
101
HUMAN INTERFACE
BOARD
104
105
(side)
POWER
100
BOARD
105
HUMAN INT.
104
(FRONT)
105
BOARD
ARM
101
CAM (RAISED)
102
CAM STAND
103
RASP BERRY PI
106
POWER SUPPLY
HUMAN INTERFACE
104
(TOP)

Top Design Description

In conclusion, the team agreed on the top design where, the power supply **100** provides power to the initial system in order to power the robot arm **101**, camera **102**, driver-vehicle interface **104**, and raspberry pi **106**. The raspberry pi **106** offers the algorithm to the system for playing tic tac toe. The user interacts with the driver-vehicle interface **104** to decide who goes first, the human or robot arm **101**. This information is taken in by the raspberry pi **106** and if the human chooses to go first then the algorithm proceeds to begin the movement of the arm **101** after it recognizes the human's turn. If the human chooses to let the robot go first, then the algorithm activates the robot's turn. The algorithm then continues to allow the player to play against the robot arm in a competitive game of tic tac toe, where the robot arm **101** uses a grip method to physically pick-up and drop its pieces to the desired position in the game. Reed sensors are used under the board to help identify which spaces are open and which are used. After each piece is placed, the camera **102** sees where the piece has been placed and signifies the owner of that space on the board **105**. When three of the same pieces have been recognized in a horizontal, diagonal, or vertical fashion, the camera **102** recognizes this, and the system denounces the winner. If players have filled the board with no recognition of three-in-a-row, the system calls a tie.