

Morphological Chart					
Components	Solutions				
	1	2	3	4	
Mechanics					
1	Garage Door Movement	Belt & Gear Multiplier	Chain & Gear Multiplier		
	Reliability	Unsatisfactory	Relieable		
	Number of Parts	Very low	Somewhat low		
	Availability of Parts	Common	Uncommon		
	Jamming and Snagging	Almost impossible	Somewhat common		
	Rigid when not moving	No	Somewhat		
2	Stopping the garage door	Proximity Sensor	Touch Sensor	Programming Control	
	Simple mechanical solution	Yes	Yes	No mechanics involved	
	Availability of Parts	Yes	Yes	Yes	
	Faliure Proof Design	Yes	Yes	No	
	Ease of Implementation	Somewhat	Easy	Somewhat difficult	
3	Controlling the door from a distance	Proximity Sensor	Touch Sensor & Bluetooth	Only Bluetooth Control	
	Simplicity	Medium	Simple	Simple	
	Availability	not enough	yes	yes	
	Price	\$\$	\$	Free	
4	Pulling Mechanism	Nylon String	Steel Wire	regular string	
	Price	\$\$	\$\$\$	\$	
	Availability	Availabe	Not available	Available	
	Strength	High	Highest	Weak	
5	Gear Arrangment	Gear Multiplier	Gear Reducer	Belt Gear	Worm and Gear
	Angular velocity (compared to motor)	Higher	Lower	Equal	Low
	Torque (comopared to motor)	Lower	Higher	Equal	Extremely High
	Availability of Parts	Yes	Yes	Yes	No
6	Door Design	Multiple Piece Articulated	Single Piece	Horizontally sliding	
	Simple design of individual pieces	Simple	Complex	Simple	
	Simple overall design	Somewhat	Complex	Simple	

	Smooth Operation	Somewhat	Smooth	Smooth	
	Compact Overall Size	Compact	Compact	Not Compact	
Electronic					
1	Central Processing Unit	Arduino Uno	Arduino Mega	LEGO NXT Brick	Rasberry Pi
	Criterion (Price)	\$	\$\$	\$	\$\$\$
	Criterion (Code Complexity)	Medium	Medium	Easy	Hard
	Criterion (Ease of Controll)	Easy	Easy	Easy	Medium
	Criterion (Component Compatilby)	All	All	Some	Most
2	Garage Door Motor	LEGO NXT DC Motor	DC Motor	Stepper Motor	Servo Motor
	Criterion (Price)	\$\$\$	\$	\$	\$
	Criterion (Ease of Controll)	Easy	Easy	Medium	Medium
	Criterion (Ease of Implementation)	Easy	Hard	Medium	Medium
3	Proximity Sensor	Infrared Sensor	Ultrasonic Sensor	LEGO NXT Ultrasonic Sesnor	Optical Sensor
	Criterion (Price)	\$	\$\$	\$\$\$	\$\$
	Criterion (Ease of Implementation)	Hard	Easy	Easy	Hard
	Criterion (Size)	Small	Medium	Large	Small
4	Bluetooth Module	HC-06 Module	BLE Module	HC-05 Module	
	Criterion (Price)	\$	\$\$	\$	
	Criterion (Ease of Implementation)	Easy	Easy	Easy	
	Criterion (Size)	Small	Small	Small	
5	Motor Driver	L298n Motor Driver	SprakFun Motor Driver		
	Criterion (Price)	\$	\$		
	Criterion (Ease of Implementation)	Easy	Medium		
	Criterion (Size)	Medium	Medium		
6	Touch Sensor	NXT Touch Sensor	Switch with lever	Button	
	Criterion (Ease of Implementation)	Easy	Medium	Medium	
	Criterion (Size)	Large	Small	Small	
	Criterion (Code Complexity)	Easy	Easy	Easy	
Software					
1	Operating System	Windows	Ubuntu	Mac OS	
	Criterion (Ease of use)	Easy	Hard	Medium	
	Criterion (Compatilby)	All	All	All	
2	Programming Software	Microsoft Visual Studio	Arduino IDE	Netbeans	

3	Programming Language	Python	C++	C#	Java
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