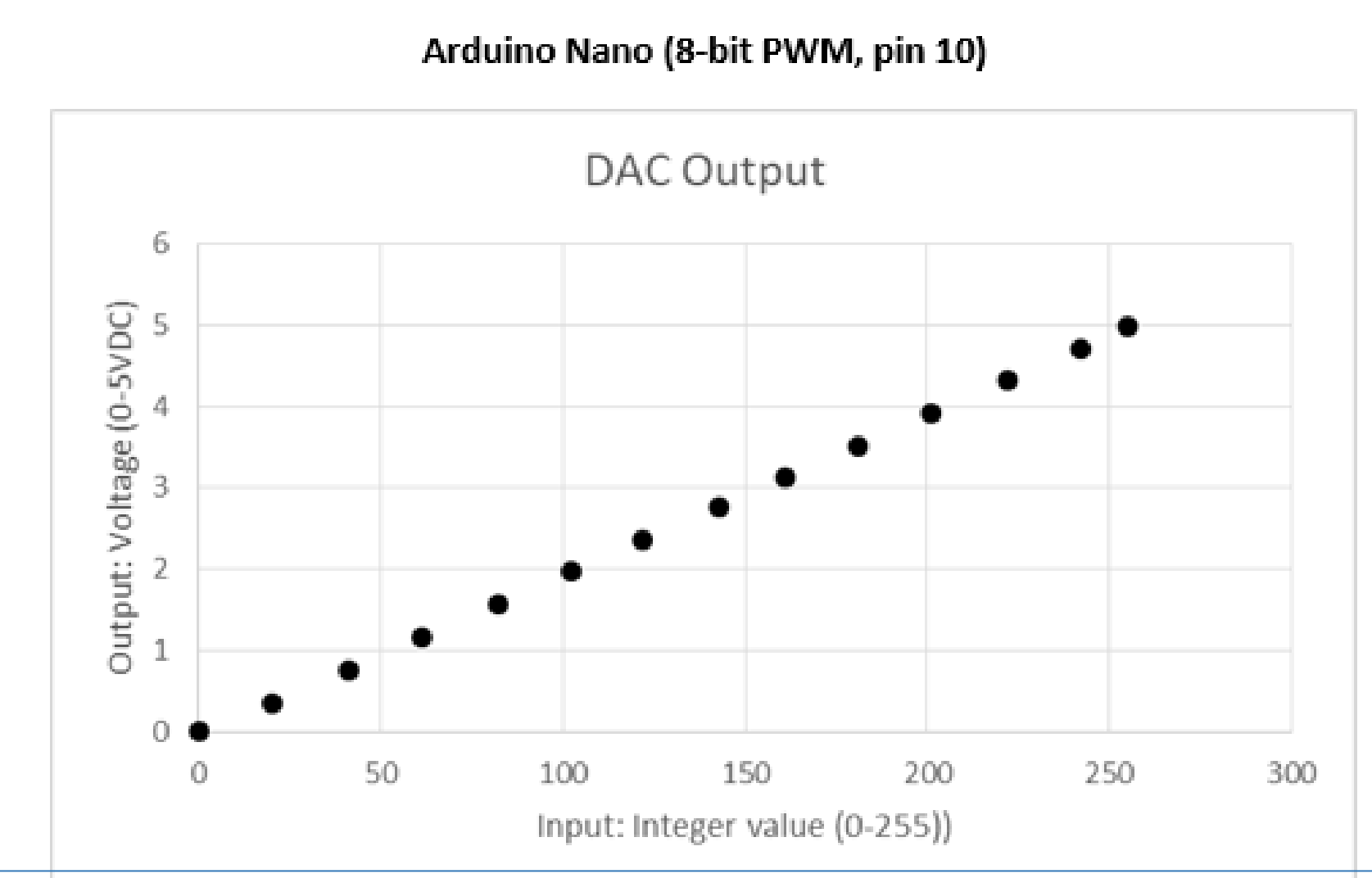
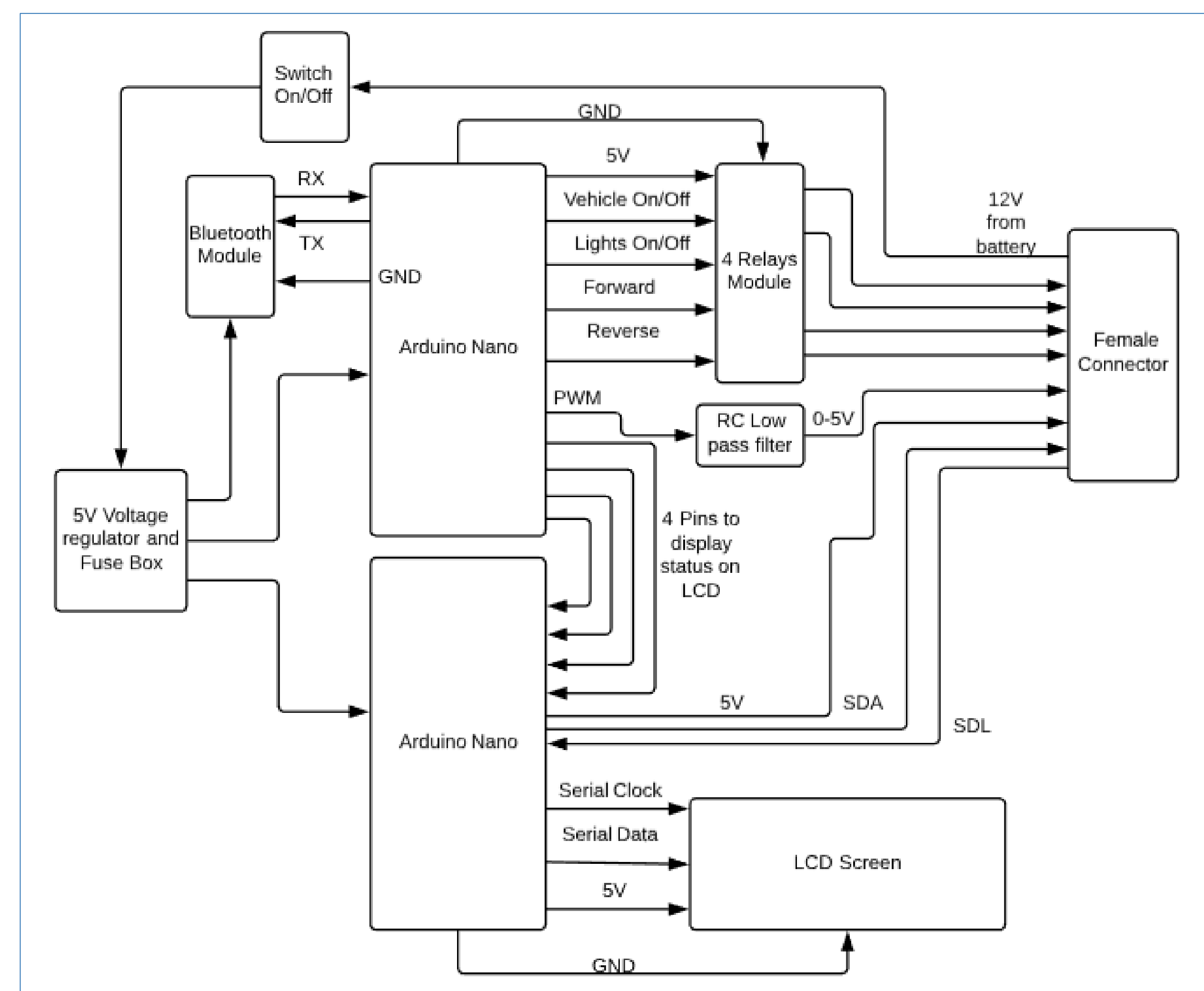


The goal of this project is to design a smart vehicle that is relevant to the most popular products in the automotive technology industry. We have utilized affordable hardware in an effort to produce a smart vehicle system that is more accessible to students. Since cell phones are a major part of millennial students' culture, we came up with the idea of controlling basic components of a Switch electric vehicle with an Android phone. The smartphone is connected to the vehicle through Bluetooth, so that an app on smartphone can turn the vehicle On/Off, lights On/Off, toggle between Forward/Reverse, and control the speed of the motor.

This system's external voltage regulator uses 12V from the battery and converts it into 5V which are distributed to each Arduino Nano. The Arduino Nano on top is used to control different commands that are received through Bluetooth module from an Android phone. The Arduino Nano at the bottom is used to display Vehicle status through LCD and it also collects and display Lidar data/Information.



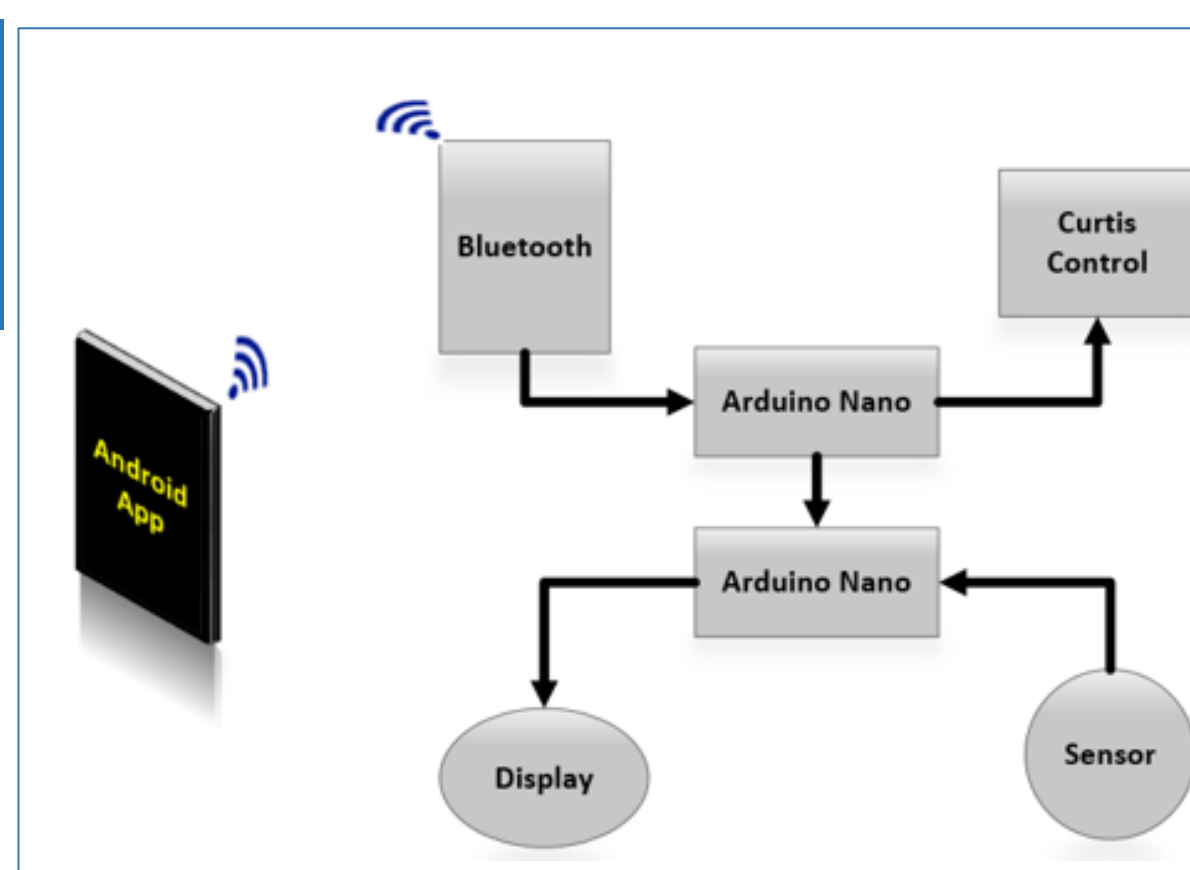
MIT app inventor was used to create app for an Android phone. The app works with most of the android phones.



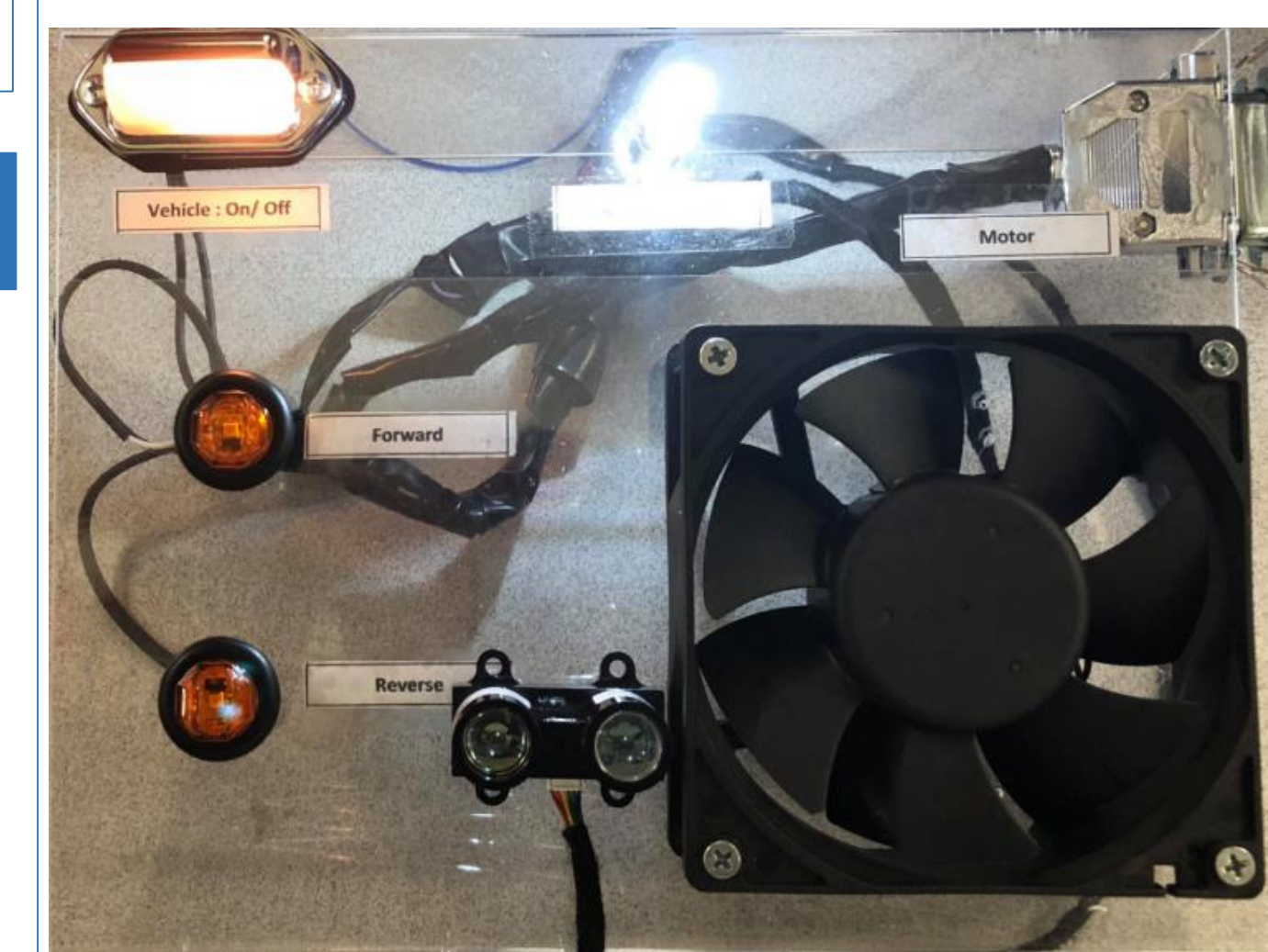
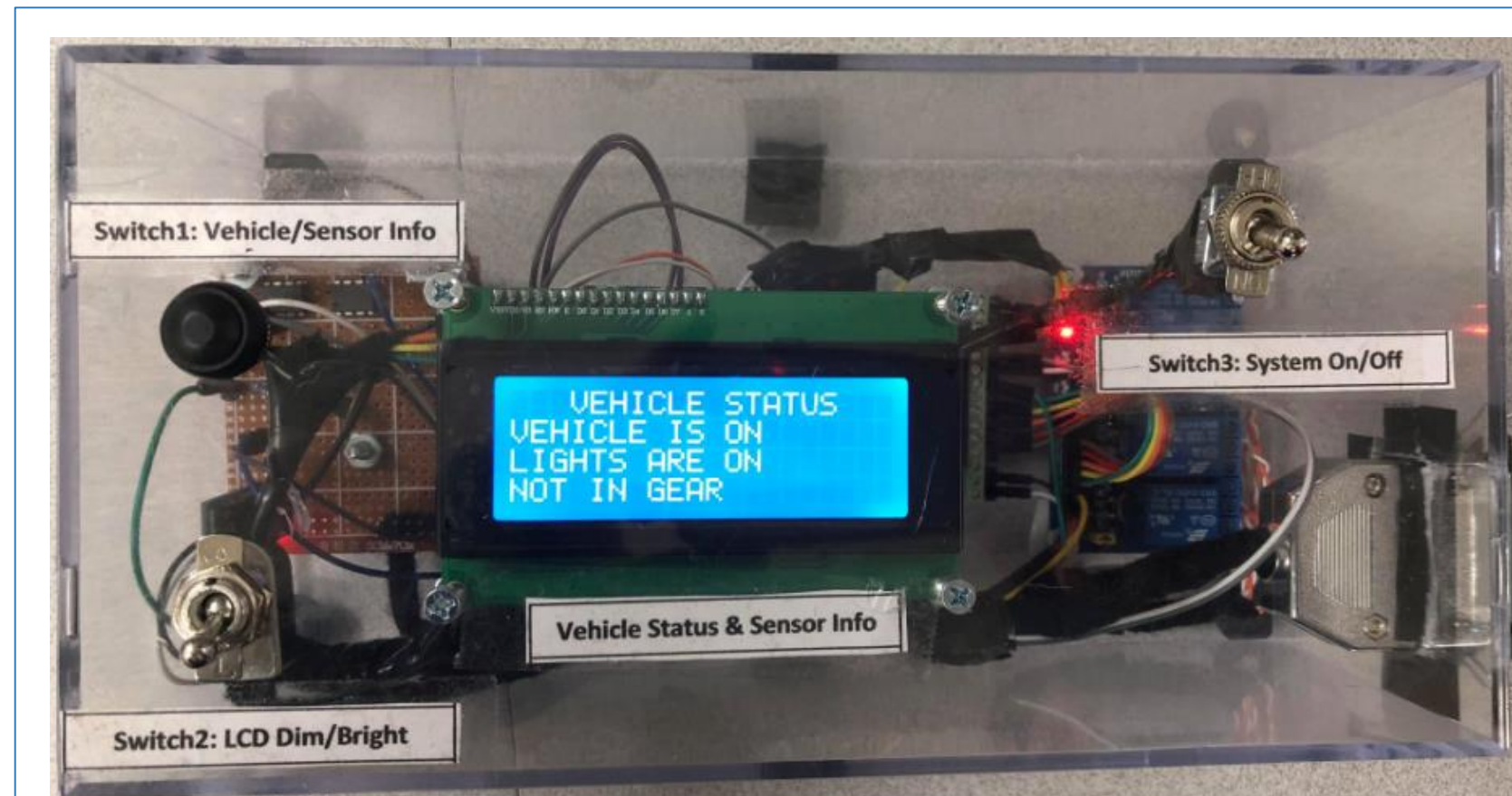
Wiring diagram for the AC35 96V Motor system:

- Power Source:** Vehicle battery 96 VDC.
- 12VDC Battery:** Connected to the Manual 12 VDC key switch.
- Manual 12 VDC key switch:**
  - Controls Headlights (12 VDC).
  - Controls Manual Blinker Switches (12 VDC).
  - Provides 12 VDC to the 12 VDC Relay Power to Curtis.
- 12 VDC Relay Power to Curtis:**
  - Provides 12 VDC to the Manual Direction switch F/R.
  - Provides 12 VDC to the Pedal Varies Speed.
- Manual Direction switch F/R:**
  - Provides Forward (12 VDC) and Reverse (12 VDC) signals to the Curtis 1238 Motor controller.
- Pedal Varies Speed:**
  - Provides 5 VDC and 0-5VDC signals to the Curtis 1238 Motor controller.
- Curtis 1238 Motor controller:** Receives control signals and provides 12 VDC to the AC35 96V Motor.

This system can be placed on the dashboard of the Switch vehicle and can also be used as an educational kit.



The Test board was used to show the proof of concept.



**Indoor Bluetooth Test no Obstructions**

This bar chart displays the number of successful trials for three different distances: 20, 30, and 40 feet. The y-axis represents 'SUCCESSFUL TRIALS' from 0 to 35. The x-axis represents 'DISTANCE (FT)'. The legend indicates that the bars represent 20Ft Test (dark gray), 30Ft Test (medium gray), and 40Ft Test (light gray).

Distance (FT)	Successful Trials
20	30
30	30
40	30

**Arduino Nano (8-bit PWM, pin 10)**

This scatter plot shows the DAC Output (Voltage 0-5VDC) versus the Input: Integer value (0-255). The y-axis ranges from 0 to 6, and the x-axis ranges from 0 to 300. The data points show a linear relationship between the input integer value and the output voltage.

Input: Integer value (0-255)	Output: Voltage (0-5VDC)
0	0.0
10	0.4
20	0.8
30	1.2
40	1.6
50	2.0
60	2.4
70	2.8
80	3.2
90	3.6
100	4.0
110	4.4
120	4.8
130	5.2
140	5.6
150	6.0

- Further research is needed to determine the blind spot with Lidar more accurately.
- Utilize more sensors and cameras to scan the environment and as a result provide a detailed report of objects detected.

Thanks to Switch vehicle for providing the test bench for our first two tests. Special thanks to Dr. Farid Farahmand and Engineering department for all the knowledge and support that they have provided.