

EET 503/617 Technical Project Proposal

Title: Control System for Primary Motorcycle Functionality

Proposed by: Cole Fuerth

Description: Building a custom electric motorcycle comes with its challenges, including designing the control system. This system will implement controls for lights, as well as an LCD display for information for the user. Modern bikes features include hazard lights and engine shutoff if in gear with the kickstand down, as well as a warning popup if the system starts and it detects a dead light.

Methodology: Multiple relay boards will be used across the bike, to control lights. The Arduino will take the input from the throttle and convert it into a PWM signal for the ESC. This control system will handle all the control in the bike, including lights, safety systems, and engine speed. The bike will be able to give an estimate on charge used so far in mAh, as well as an instantaneous current draw in Amps. A suitable brushless motor, ESC, and battery will be needed to power the system.

Major Components/Budget: Two Arduino Mega boards, a 480x320 LCD, handlebar controls, and new turn signals, headlight, taillight, and fog lamps will be purchased for the bike. All systems on the bike will be controlled using switching circuits distributed to different parts of the bike. There will be a light test sequence to ensure all lights are connected. There will also be a system to monitor battery levels. There will need to be a suitable frame, motor, ESC, and battery chosen. The total of all listed components, along with an estimate for minor components, is about \$2500CAD.

Scope of Original Work: I will be picking a motor, esc and batteries for the system. All of the lights and electrical will be ordered. The system will not operate using a key; only the physical XT90 battery connection. I will be sequencing all of the lights and all of the control for the bike, except for the ESC itself, controlled with a PWM signal.

Preliminary I/O List:

Digital Pin	Use	Purpose
0	Serial	HMI Comms
1	Serial	HMI Comms
20	Serial	RTC
21	Serial	RTC
22	Output	Headlight Low NC
23	Output	Headlight High
24	Output	Taillight Low NC
25	Output	Taillight High
26	Output	Fog Lights
27	Output	FL Turn NC
28	Output	FR Turn NC
29	Output	RL Turn
30	Output	RR Turn
32	Output	Killswitch NC
38	Input	Killswitch
39	Input	Lights On

Digital Pin	Use	Purpose
40	Input	Fog Lights On
41	Input	Lights Off / Trail Mode
42	Input	Start PB
43	Input	High/Low SW
44	Input	Hazard Lights
45	Input	Turn Left
46	Input	Turn Right
47	Input	Horn
Analog	Use	Purpose
0	Input	Throttle Position
2	Input	Main Ammeter
3	Input	Control Ammeter
4	Input	Main Batt Voltage

Proposed Sequence of Operation:

- New handlebar controls will be purchased, with functionality for:
 - o Right side will be light modes (normal, fog, dark), killswitch, and starter button
 - o Left side will be bright/dim switch, hazards, turn signals, and horn
- Touchscreen HMI will be used for interface with human, it will include:
 - o Speed
 - o Odometer
 - o Current draw
 - o Batt usage since last charge (mAh)
 - o Time
 - o Neutral/fwd ind.
 - o Brights ind.
 - o Fog lights ind.
 - o Turn signal ind.
 - o Estimated range
- LED lights will be purchased for systems on the bike, these new lights will include:
 - o Headlight
 - o Taillight/Brake Light
 - o Turn Signals
 - o Fog Lamps
- Bike will kill the engine if the system is put into gear with the kickstand down
- The bike will log the following activity:
 - o Current draw since last charge
 - o Odometer

Potential Issues: An entirely new cluster will need to be fabricated and waterproofed. Bussing wires around the bike will be difficult. System will need to be safe, because lithium has an extremely high potential energy when charged. Noise from the motor will be an issue, as well as measuring the high levels of current draw.

Milestones: Ordering components, Testing components, System design, Sequencing the system, Designing the HMI screens, wiring and mounting lights, wiring and mounting cluster, waterproofing cluster, debugging and testing final operation.

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October 8, 2019

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8 Oct. 2019