Report:
STEERING SUBSYSTEM

LTTS GLOBAL ENGINEERING ACADEMY

L&T Technology Services

Version Number:
Team Members :
Team No:
Module: Model Based System Engineering

DECLARATION

I hereby declare that the attached documents are correct and valid to the best of my knowledge.

BALAJI S B

PROBLEM STATEMENT:

• Now-a-days, the world is being automated in almost every industry. In the vehicle industry, there is an initial stage of study of automation.

• In manual mode, a human driver should always be present inside the vehicle. This consumes a lot of human power.

• On an average, people spend about an hour each day and travel 31.5 miles, a five percent increase from 2014.

• In the busy world, it is a huge time-consuming process. There are some other issues such as drunk and drive etc., which causes accidents leading to death of human life.

ABSTRACT:

The automatic control of a vehicle's steering wheel is now one of the most important challenges in the Intelligent Transportation Systems field. A steering control system for the path tracking of autonomous vehicles is described. The steering control system consists of a path tracker and primitive driver. The path tracker generates the desired steering angle by using the look-ahead distance, vehicle heading, and a lateral offset. The steering controller controls the steering actuator to follow the desired steering angle. A DC motor with Incremental encoder is installed to control the steering handle and these messages are transported using CAN protocol.

COMPONENTS:

STM32f103RB MICROCONTROLLER:

STM32 is a family of 32-bit microcontroller integrated circuits by STMicroelectronics Internally, each microcontroller consists of the processor core, static RAM, flash memory, debugging interface, and various peripherals. STM32 is a family of 32-bit microcontroller integrated circuits by STMicroelectronics. The STM32 chips are grouped into related series that are based around the same 32-bit ARM processor core, such as the Cortex-M33F, Cortex-M7F, Cortex-M4F, Cortex-M3, Cortex-M0+, or Cortex-M0. Internally, each microcontroller consists of the processor core, static RAM, flash memory, debugging interface, and various peripherals. The STMicroelectronics STM32F103RB is an ARM 32-bit Cortex-M3 Microcontroller, 72MHz, 128kB Flash, 20kB SRAM, PLL, Embedded Internal RC 8MHz and 32kHz, Real-Time Clock, Nested Interrupt Controller, Power Saving Modes, JTAG and SWD, 3 Synch. 16-bit Timers with Input Capture, Output Compare and PWM, 16-bit 6-ch Advanced Timer, 2 16-bit Watchdog Timers, SysTick Timer, 2 SPI, 2 I2C, 3 USART, USB 2.0 Full Speed Interface, CAN 2.0B Active, 2 12-bit 16-ch A/D Converter, Fast I/O Ports.

GEARED DC MOTOR:

Gear motor is an all-in-one combination of a motor and gearbox. The addition of a gear head to a motor reduces the speed while increasing the torque output. Most of our dc motors can be

complemented with one of our unique gear heads, providing you with a highly efficient gear motor solution.

CYTRON MOTOR DRIVER:
It supports both sign-magnitude PWM signal and locked-anti phase. It is compatible with full solid-state components resulting in higher response time and eliminates the wear and tear of the mechanical relay. DC brushed motors are the most commonly used and widely available motors in the market. The Cytron 10 Amp 5 V - 30 V DC Motor Driver will help you add functionality to your DC motor.

INCREMENTAL ENCODER:
An incremental encoder is a linear or rotary electromechanical device that has two output signals, A and B, which issue pulses when the device is moved. Together, the A and B signals indicate both the occurrence of and direction of movement. Many incremental encoders have an additional output signal, typically designated index or Z, which indicates the encoder is located at a particular reference position. Also, some encoders provide a status output typically designated alarm that indicates internal fault conditions such as a bearing failure or sensor malfunction.

JETSON TX2 :
Jetson TX2 is the fastest, most power-efficient embedded AI computing device. This 7.5-watt supercomputer on a module brings true AI computing at the edge. It's built around an NVIDIA Pascal™-family GPU and loaded with 8GB of memory and 59.7GB/s of memory bandwidth. NVIDIA ® Jetson Nano™ Developer Kit is a small,

powerful computer that lets you run multiple neural networks in parallel for applications like 9 image classification, object detection, segmentation, and speech processing. All in an easy-to-use platform that runs in as little as 5 watts. NVIDIA Jetson TX2 is an embedded system-on-module (SoM) with dual-core NVIDIA Denver2 + quad-core ARM Cortex-A57, 8GB 128-bit LPDDR4 and integrated 256-core Pascal GPU. Useful for deploying computer vision and deep learning, Jetson TX2 runs Linux and provides greater than 1TFLOPS of FP16 compute performance in less than 7.5 watts of power. Jetson TX2 is available as the module, developer kit, and in compatible ecosystem products. See the wiki of other Jetson's here, including the latest Jetson AGX Xavier.

Processing Components

- dual-core NVIDIA Denver2 + quad-core ARM Cortex-A57
- 256-core Pascal GPU
- 8GB LPDDR4, 128-bit interface
- 32GB eMMC
- 4kp60 H.264/H.265 encoder & decoder
- Dual ISPs (Image Signal Processors)
- gigapixel/sec MIPI CSI camera ingest 10 Ports & Peripherals
- HDMI 2.0
- 802.11a/b/g/n/ac 2×2 867Mbps WiFi
- Bluetooth 4.1
- USB3, USB2
- 10/100/1000 BASE-T Ethernet
- 12 lanes MIPI CSI 2.0, 2.5 Gb/sec per lane
- PCIe gen 2.0, 1×4 + 1×1 or 2×1 + 1×2
- SATA, SDcard

- dual CAN bus
- UART, SPI, I2C, I2S, GPIOs

CAN- CONTROLLER AREA NETWORK:

The Controller Area Network (CAN) is a serial communication bus designed for robust and flexible performance in harsh environments, and particularly for industrial and automotive applications A Controller Area Network (CAN bus) is a robust vehicle bus standard designed to allow microcontrollers and devices to communicate with each other's applications without a host computer. It is a message-based protocol, designed originally for multiplex electrical wiring within automobiles to save on copper, but can also be used in many other contexts. 11 For each device the data in a frame is transmitted sequentially but in such a way that if more than one device transmits at the same time the highest priority device is able to continue while the others back off. Frames are received by all devices, including by the transmitting device.

LEVEL SHIFTER:

A level shifter in digital electronics, also called logic-level shifter or voltage level translation, is a circuit used to translate signals from one logic level or voltage domain to another, allowing compatibility between ICs with different voltage requirements, such as TTL and CMOS. This level converter- 4 channel features four high speed bi-directional 4 channels, allowing for safe and easy communication between devices operating at different logic levels. The logic level converter circuit convert signals as low as 1.8 V to as high as 5 V and vice versa, and its four channels are enough to support most

common bidirectional and unidirectional digital interfaces, including IC, SPI, and asynchronous TTL serial.

Technologies/Tools Learnt:

1. STM32 Microcontrollers.
2. Electric Circuits.
3. Motors, Actuators and Encoders
4. Control systems and Battery management.
5. STMCubeMX.
6. Eclipse for embedded C.

IMPLEMENTATION:

The ability to modify the pre-scalar value for encoder enables us to increase the accuracy of encoder reading for a degree of turn. But when we try to control the motor with this value, the encoder may skip some values and will not give the required results. So we tested the encoder with specific pre scalar values to find optimum pre scalar value which will give good control over the motor and doesn't skip any encoder values.

RESULT:

Hence, the implementation of CAN Protocol using STM Microcontrollers is successfully established and the solution of Autonomous electric vehicle is arrived.