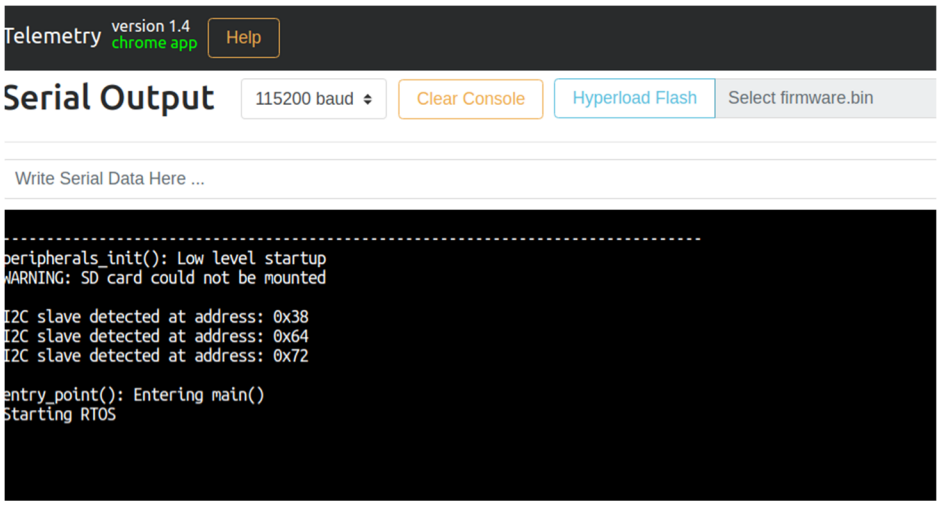
LAB 10: I2C

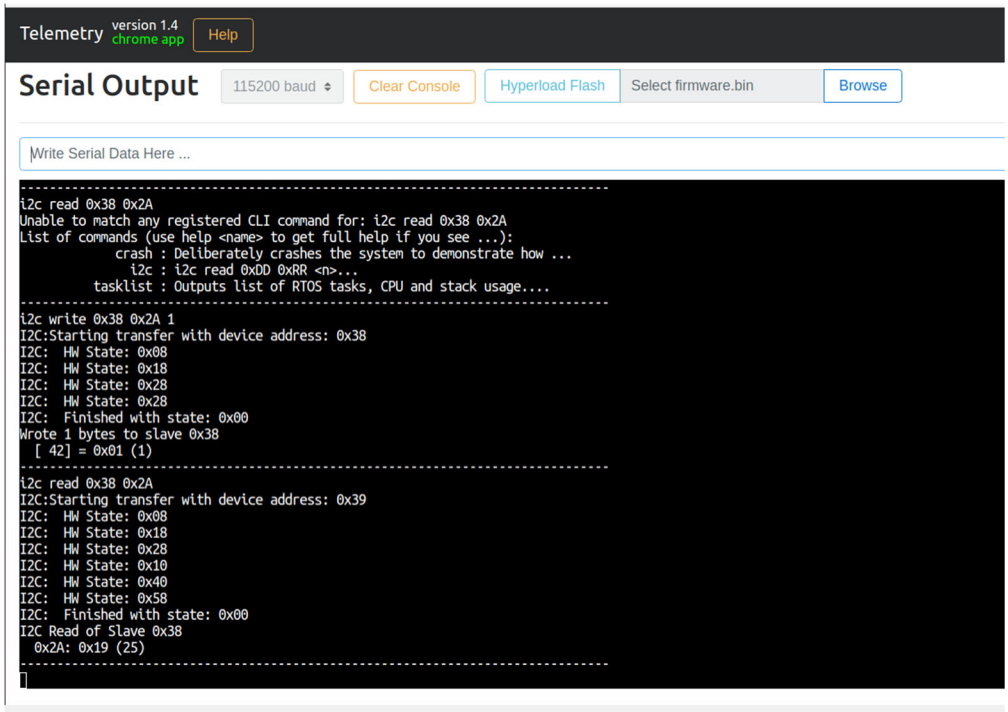
PART 1:

a) The following figure shows slave addresses of I2C read from telemetry.

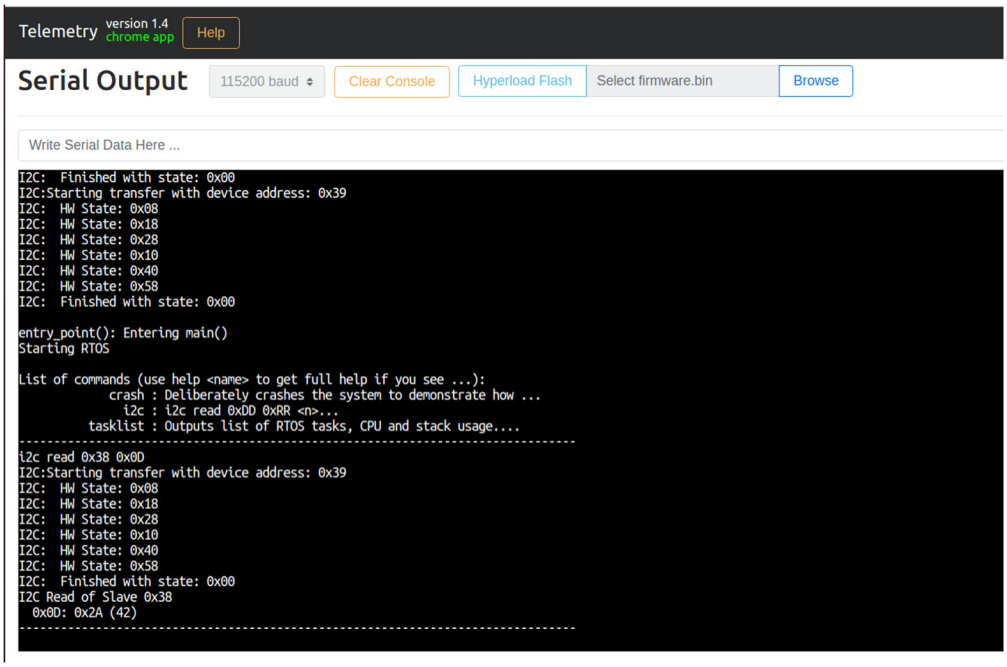


b) The attached file I2C_Enable.txt with this code shows the printf statements after debugging was enabled

c) The following figure is output after writing values into ***CTRL_REG1*** (0x2A) to activate the sensor



d) The following figure is output after writing values into ***WHO_AM_I*** (0x0D) register to activate the sensor:



e) The following 3 screenshots is the values read from XYZ of accelerometer:

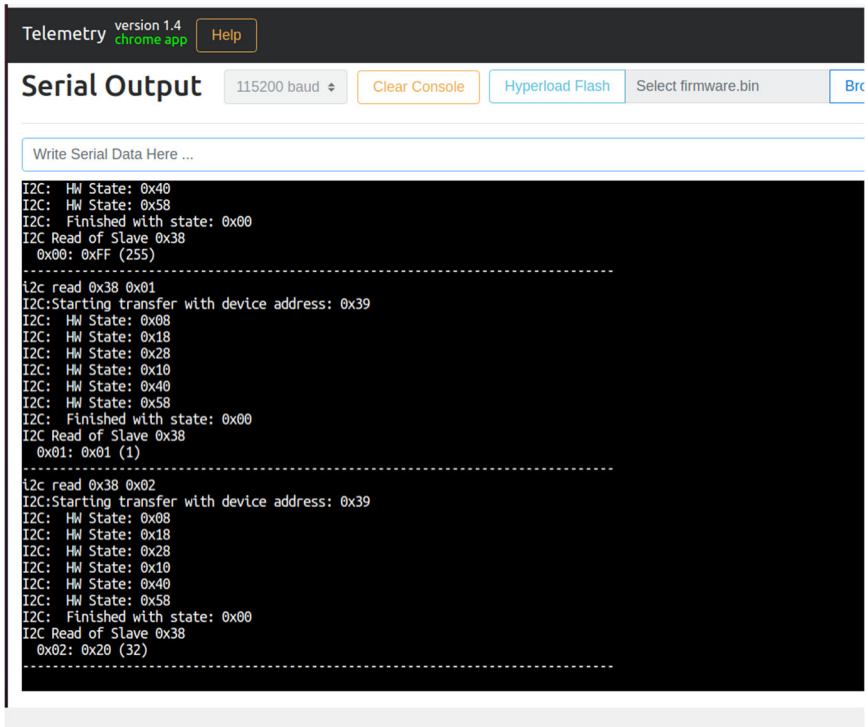


Figure: X-Axis

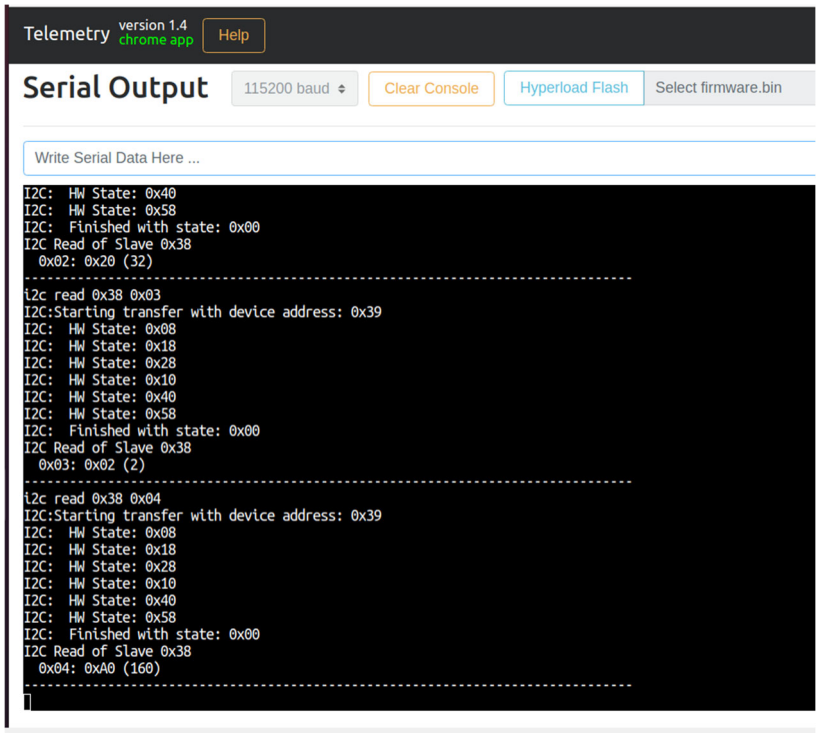


Figure: Y-Axis

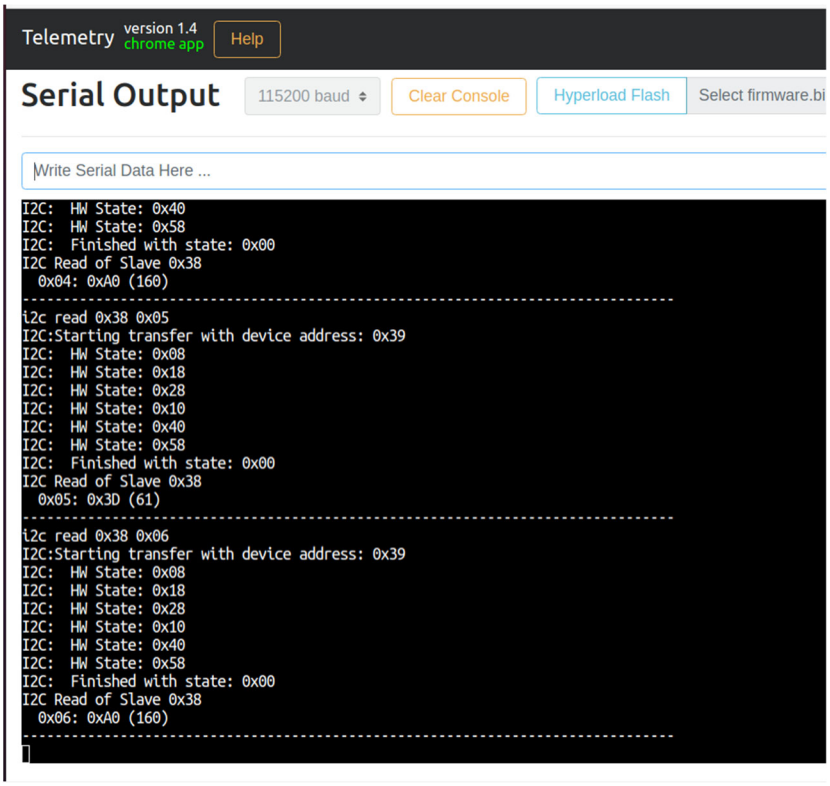


Figure: Y-Axis

PART 2: State Diagram when Slave is Transmitting and Receiving

The attached excel sheet in repository gives a detailed analysis of what each status code represents. Below is just an example when reading and writing a memory location. The table explains the meaning of each state represented by the state diagram.

The following represents state diagram and table which explains the steps when slave is considered as receiver and Master needs to write data into a memory location.

Writing into the Memory Location								
	START	SLA+W	ACK	Memory Location	ACK	DATA	ACK	STOP
SLAVE STATE		0x60		0x80		0x80		0xA0
						Repeated fro N Bytes		
				Repeated for N different addresses				

State Diagram 1

HW State	Why you got here?	Action to take
Writing into the Memory Location: Slave Read		
Initially a START bit is sent from the Master side followed by SLA+W to indicate the slave address and write operation into the Slave.		
0x60	Slave receives its own address along with the W bit	ACK is sent by slave. Then wait for next data byte from Master which would signify the register address.
0x80	Slave receives the data from Master which corresponds to the memory location to be written.	Slave in return send ACK bit and waits for the data to be written
0x80	Slave receives the data from Master which corresponds to the data which should be written into the memory location received from above.	Slave in return send ACK bit and waits for the next data to be written
0xA0	Master sends a STOP bit to stop this transaction	There is no acknowledgment sent back to the Master. SI bit is cleared.

Table 1

The following represents state diagram and table which explains the steps when slave is considered as transmitter and Master needs to read data from a memory location.

Reading from the Memory Location												
	START	SLA+W	ACK	Memory Location	ACK	Repeat START	SLA+R	ACK	DATA	ACK	DATA	NACK	STOP
SLAVE STATE		0x60		0x80			0xA8		0xB8		0xCO		0xC8
									Repeated fro N Bytes		Last Byte		

State Diagram 2

HW State	Why you got here?	Action to take
Slave Write: Reading from Memory Location		
Initially START bit is sent from Master dollowed by SLA+W and in return the slave has to acknowledge this bit. The Master has to write the first data byte., then send a REPEAT START bit and then send SLA+R to start transaction.		
0xA8	Slave receives its address and Read bit.	ACK is sent by slave.
0xB8	As soon as read bit is received Slave will send the ACK and transmit first data byte.	Master will send ACK in return and wait for next byte. Slave needs to verify if ACK is received or NACK. If ACK is received it is ready to send the next byte and stay in this state.
0xB8	This state is repeated for N bytes. Each time ACK is received from Masters side	Master will send ACK in return and wait for next byte. Slave needs to verify if ACK is received or NACK. If ACK is received it is ready to send the next byte and stay in this state.
0xC0	The data byte is transmitted from Slave and Master send NACK to stop the transaction	Slave waits for reception of stop bit.
0xC8	Last Data byte is transmitted and NACK is received.	Slave stops the transaction and clear SI.

Table 2