

Design and Development of a 1-Wire Multi Master Embedded Communication Protocol



T. N. Raj Vignesh

tnrajvignesh@gmail.com
Ph. No: 0 97918 48808

Student's Name	T. N. Raj Vignesh	RTES (FT-2012)
Academic Supervisor(s)	K. R. Narasimha Murthy and P. Padma Priya Dharishini	
Industrial Supervisor(s)		

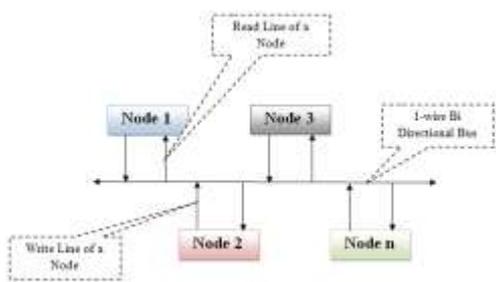
Keywords: Multi Master 1-Wire, Single Wire Communication, Priority Handling, Embedded Communication

Abstract:

Embedded communication protocols define a common set of rules that are to be followed when two devices in an embedded system are to communicate. A good protocol is characterised by simplicity of hardware, fast data rates, less error rate, more number of nodes, multiple master provision, etc. The necessity of a better protocol always exists as long as there are demerits exhibited by the existing protocols. 1-Wire protocol has recently joined the group of embedded communication protocols and is the protocol with the simplest hardware architecture. But it allows only single master to exist on the bus, which cannot be employed in a system where multiple peripherals of different priority have some critical data to be conveyed to another peripheral. So there arises a need for a multi master protocol which is simple in terms of both hardware and software perspective.

In this project, a 1-Wire multi master embedded communication protocol is implemented on a micro controller platform. The protocol allows multiple masters to exist on a single wire bus. It uses a novel access share distribution scheme to allot weighted access to all the masters on the bus. The frame formats are designed such that there is optimal overhead. The protocol is implemented in C programming language for Arduino platform and simulated using Proteus VSM simulator. The validated protocol is then ported to Arduino hardware and its performance is evaluated.

The simulation environment consisting of two masters and two slaves validated the working of the protocol. Then the code was ported to a setup of four micro controllers on breadboard. The developed 1-wire multi master embedded communication protocol observed for its functionality, behaviour and performance by varying the number of nodes and other variable parameters of the protocol. It is seen that the developed 1-wire multi master embedded communication protocol is 90 times faster than the single master 1-wire protocol, while maintaining the same simplicity of hardware. Some of the enhancements to this protocol can include hot plugging of nodes, error correction and improving energy efficiency.



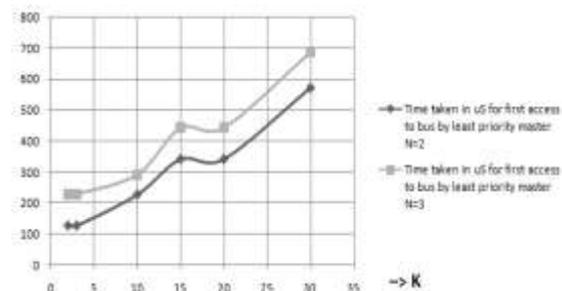
Block diagram of 1-wire bus architecture



Simulation setup with two masters and two slaves

Sno	Protocol Name	Time Taken to Send Payload of Different Sizes (us)	
		Simulation Result for 8 Bit Data	Simulation Result for 64 Bit Data
1	UART	20	76
2	SPI	36	56
3	I2C	24	52
4	LIN		11860
5	CAN	16816	39488
6	FlexRay		36
7	1-Wire Single Master	2440	13364
8	Proposed 1-Wire Multi Master protocol	48	146

Comparison of transmission time



Performance of the developed protocol