



SMART HOME SYSTEM

Embedded System

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INTRODUCTION:



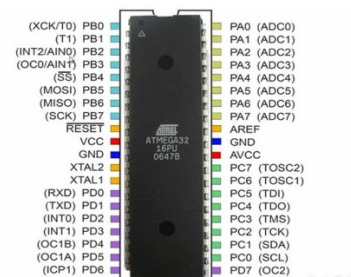
The world is evolving more and more every day thus, we need to build more systems and programs that human in daily tasks and to be much more practical. One of the top emerging technologies nowadays is the Embedded Systems. These systems are a combination of hardware and software to do specific function. We will use this technology to produce a smart home system for human as this application would have great impact on life. By this technology, human can enjoy the facility of controlling home appliances using his smartphone from outside. This would be more secure and safe, convenient, and would save energy and time.

MICRO-CONTROLLER USED:

A microcontroller contains one or two CPUs, memory and programmable I/O peripherals. It is used mainly for embedded applications.

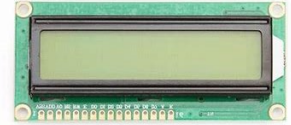
ATMEGA32

- It is one of the popular ATMEL microcontrollers.
- It has 32K Bytes of In-System Self-Programmable Flash.
- Has four ports each port has 8 pins. [32 input/output pins]
- All pins have specific protocols and functions that can be used while programming.
- Can execute up to 16 MIPS.
- It can be programmed by serial peripheral interface or by parallel programming.



COMPONENTS USED:

- **LCD 16x2:** to display comments while the system is running.



- **LEDs:** three leds are used to be controlled from smartphone.



- **BUZZER:** gives a short ring while running each actuator.



- **Relay:** represents the home door



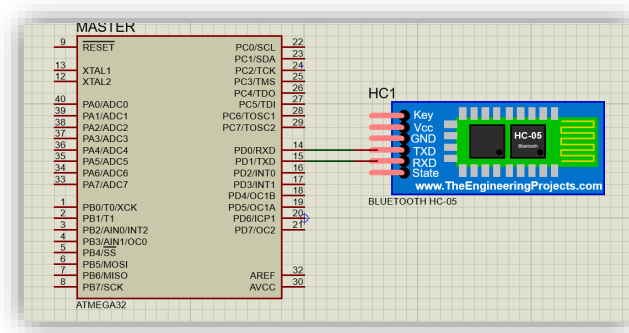
- **Bluetooth module HC-05:**

This is used to connect the smartphone with the AVR wirelessly.



METHOD:

1) Connecting Bluetooth to master chip AVR: 'UART'



- Based on our design, data should be transferred from a smartphone to the AVR, for this step to be done, we should use a Bluetooth module.
- UART is the used peripheral for this operation, where Bluetooth module is connected to the pins of UART (receive / transmit) in the microcontroller.
- By this data sent from smartphone through Bluetooth and is received the UART in AVR.

UART:

'Universal Asynchronous Receiver Transmitter', is a computer hardware device for asynchronous serial communication.

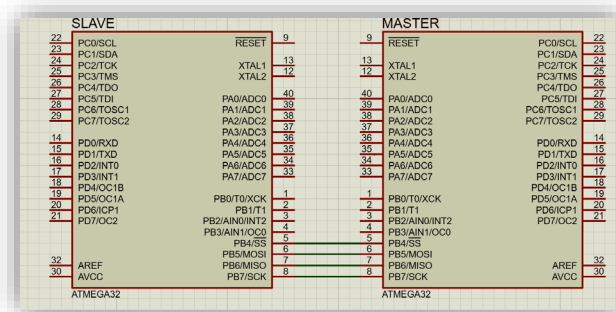
- It is a serial communication protocol.
- Wired communication protocol.
- Asynchronous communication protocol.
- Full duplex communication protocol.
- Pair to pair [single Master- Single slave]

UDR is the UART data register where the data received by UART is stored in.

Asynchronous: not time dependent.

Baud rate: number of symbols received per second.

2) Connecting master to slave: 'SPI'



- After data is received by UART and stored, this data is transmitted to another slave chip.
- This could be done using the serial peripheral interface SPI.
- Master shares clock with slave and select which slave should reply.
- Then master will send low pulse to selected slave.
- And finally, the transmitting operation will start based on data shifting.

- **SPI:**

‘Serial Peripheral Interface’, is a synchronous serial communication interface specification used for short-distance communication.

- Serial communication protocol.
- Wired communication protocol.
- Synchronous communication protocol.
- Full duplex.
- Single master multi slave.

Synchronous: time dependents of master that will be shared with slave.

Pins used:

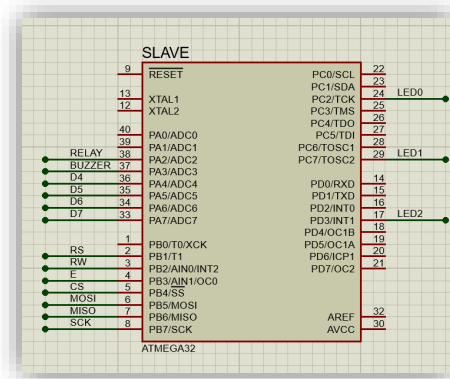
MOSI: master output slave input.

MISO: master input slave output.

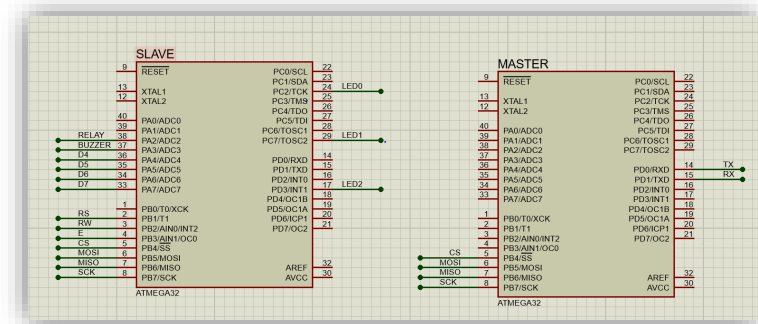
CLK: clock shared by master.

SS: slave/chip select.

3) Actuators connected to slave chip:



- The final step for this system is to connect all actuators which represent home appliances to the slave chip.
- Data received by slave chip through SPI can control all actuators that are connected to it.



SYSTEM EXPLANATION:

- In this project, we used layered architecture method where all driver codes of peripherals [MCAL layer] were written.
- Then drivers of hardware or modules were also written [HAL layer].
- At finally files are included as Macros in the main file [APP layer], to implement our system.
- Simply, the user connects smartphone to the master chip through the Bluetooth module
- Data sent by phone is received by UART and stored, then transmitted to slave chip through SPI.
- Data received by SPI can control the actuators (home appliances/led/door).

CODE EXPLANATION:

- If data received by UART is '1':
LCD connected to slave should give 'ROOM 1' as a comment, and LED0 should turn ON with a buzzer ring 1s during the action.
If '1' sent again, it toggles and LED0 will turn OFF with another buzzer ring
- If data received by UART is '2':
LCD should give 'ROOM 2' as a comment, and LED1 should turn ON with a buzzer ring 1s during action.
If '2' sent again, it toggles and LED1 will turn OFF with another buzzer ring
- If data received by UART is '3':
LCD should give 'ROOM 3' as a comment, and LED2 should turn ON with a buzzer ring 1s during action.
If '3' sent again, it toggles and LED2 will turn OFF with another buzzer ring
- If data received by UART is '4':
LCD should give 'DOOR OPEN' as a comment, and the relay which represents door should turn ON with a buzzer ring 1s during action.
If '4' sent again, it toggles, and relay will turn OFF with another buzzer ring

FLOWCHART OF SYSTEM:

