

HOME AUTOMATION SYSTEM

~ASSISTED WITH A MOBILE APP~

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1. The aims and the objectives of the project

Home automation involves introducing a degree of computerized or automatic control to certain electrical and electronic systems in a building. These include lighting, temperature control, security systems, electronic doors, fans etc. A hardware system is installed to monitor and controls various appliances. The system would control the appliances based on its configuration. For example, it could automatically turn on the lights at a specified time in the evening, or it could measure the ambient light using a hardware sensor and turn on the lights when it grows dark.

The project *HOME AUTOMATION SYSTEM* demonstrates a system that can be integrated into a building's electrical system that allows the user to control it with a wireless device such as a Bluetooth enabled mobile phone.

2. Description of the methodology used to design the project

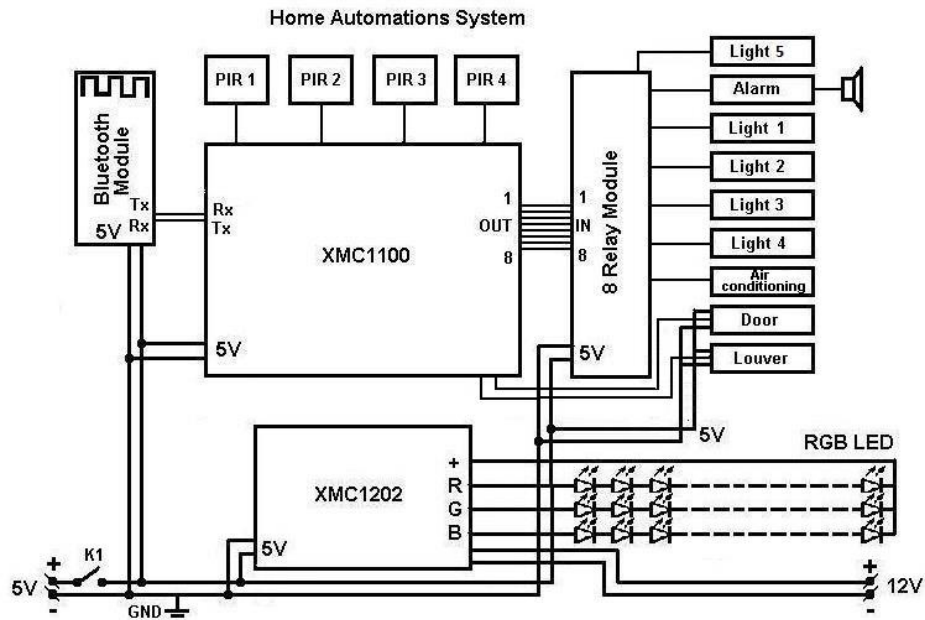
The project was designed in two stages. First step contains the automatic aspect which allows to control the lighting, electric door, the electric blinds system and the air conditioning. The other part contains the security system. A series of proximity sensors assures there is no unwanted action in the house. In case it is activated a series of LEDs and speakers indicates the danger and exposes the intruder.

There have been used a miniature model of a house that offers a clear overview of the functionality and applicability.

3. Hardware components design

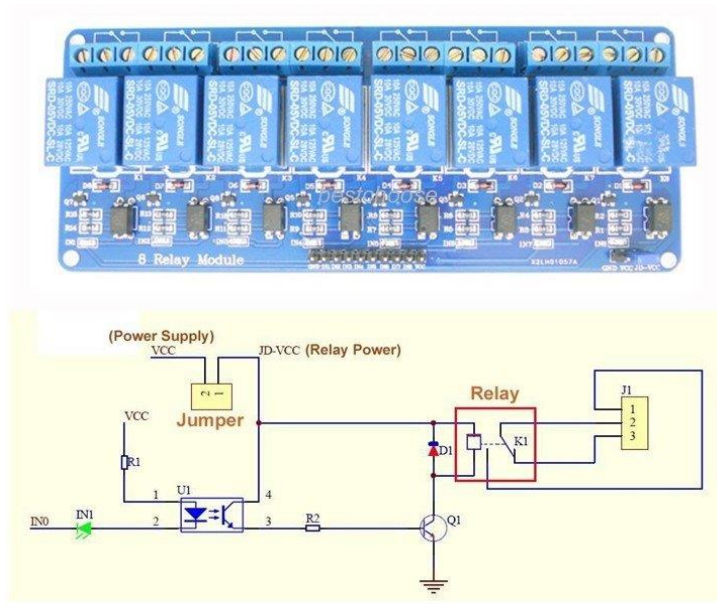
Home automation is built using XMC110 – INFINEON, XMC1202 LED Light Module, HC-06 Bluetooth Module, 8 Channel DC 5V Relay Module, PIR Sensor SR501+, Tower Pro Micro Servo and Alarm.

Block diagram:



Components:

a) 8 Channel DC 5V Relay Module



Description:

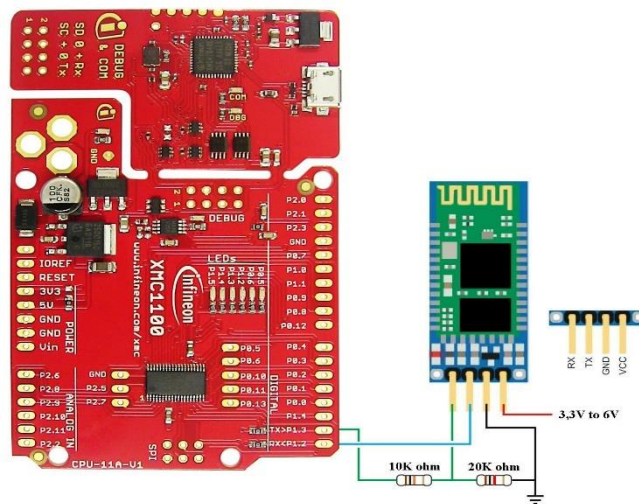
This is a 5V 8-Channel Relay interface board, able to control various appliances and other equipments with high current. It can be controlled directly by XMC1100.

Features:

- 5V 8-Channel Relay interface board, and each one needs 15-20mA Driver Current;
- Equipped with high-current relay, AC250V 10A ; DC30V 10A;
- Standard interface that can be controlled directly by XMC1100;
- Indication LED's for Relay output status.

b) Bluetooth Module

The Bluetooth module the HC-06 is based on, the EGBT-046S, is a 3.3V device. The HC-06 breakout board has a 3.3v regulator that allows a larger input voltage to be used, in the range of 3.6 to 6 volts. The RX pin can still only accept 3.3V though. This means a voltage divider is required to connect to a 5V XMC1100. A simple voltage divider can be created using 2 resistors. I am using a 1K ohm resistor and a 2K ohm resistor. The XMC1100 will read 3.3V as a HIGH so the HC-06 TX pin can be connected directly to the XMC1100.



HC-06 Vin to 5V (can be from the +5V out from the XMC1100)

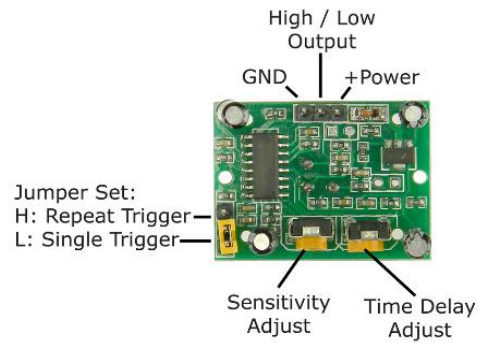
HC-06 GND to common GND

HC-06 RX to Arduino pin D3 (TX) via a voltage divider

HC-06 TX to Arduino pin D2 (RX) connect directly

c) PIR Sensor SR501+

Small PIR sensor. The detecting distance, the delay time and the output signal can be adjusted.



The first trimmer potentiometer is used to adjust the sensor sensitivity (the default is 50%)

The second trimmer potentiometer is used to adjust the length of time the sensor will go up to 3V output when it detected a movement. (By default, a few seconds)

Jumper Setting

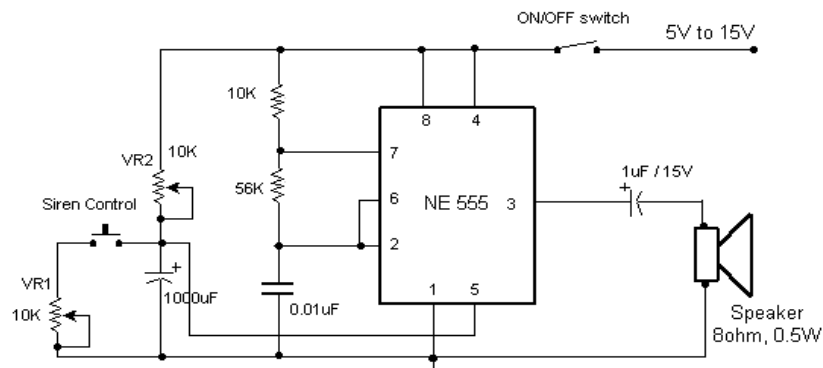
Position	Mode	Description
H	Retrigger	Output remains HIGH when sensor is retriggered repeatedly. Output is LOW when idle (not triggered).
L	Normal	Output goes HIGH then LOW when triggered. Continuous motion results in repeated HIGH/LOW pulses. Output is LOW when idle.

d) Alarm

This circuit produces a sound similar to a factory siren.

It makes use of a 555 timer IC used as an astable multivibrator of a center frequency of about 300Hz.

The frequency is controlled by the pin 5 of the IC. When the supply is switched ON, the capacitor charges slowly and this alters the voltage at pin 5 of the IC hence the frequency gradually increases.



After the capacitor is fully charged, the frequency no longer increases. Now when the push button siren control switch is held depressed, the capacitor discharges and the siren frequency also decreases.

The presets VR1 and VR2 should be adjusted for optimum performance.

e) Micro servo



A servo motor is an electrical device which can push or rotate an object with great precision. If you want to rotate an object at some specific angles or distance, then you use servo motor. It is just made up of simple motor which runs through servo mechanism. If motor is used is DC powered then it is called DC servo motor, and if it is AC powered motor then it is called AC servo motor.

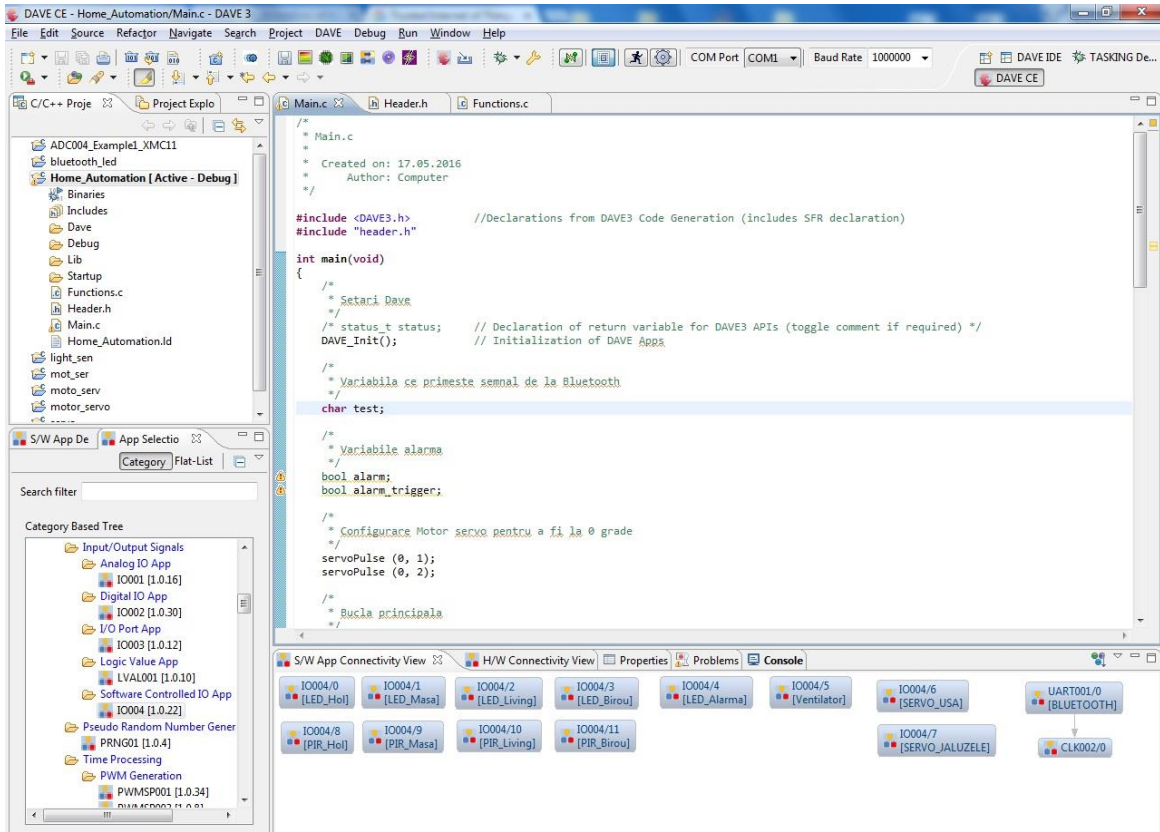
4. Software components design

DAVE 3:

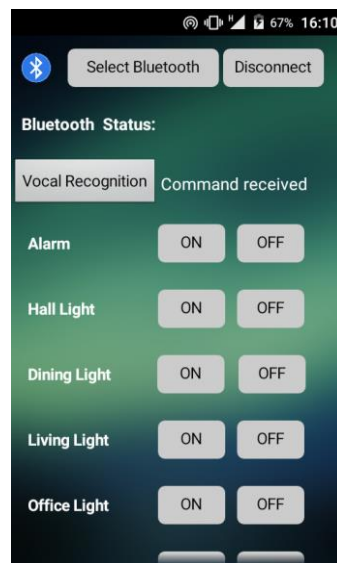
- Apps:



- Software:



App for Smartphone: made with MIT App Inventor 2



5. Network components

Bluetooth module (HC-06):



6. Security components

- App is password protected with username and password;
- Bluetooth is password protected with a 4 key pin;
- Alarm system with speaker, intermittent lighting and PIR sensors.

7. Infineon hardware/software components used

Hardware:

1) XMC1100-T038F0064 AA (*32-bit Microcontrollers with ARM® Cortex®-M0*)

Summary of Features:

- 64KB Flash, 16KB RAM
- 2.0 - 5.5V
- 4 x 16-bit timers
- 6 channel 12-bit ADC
- 2 channel USIC (configurable to SPI, UART, IIC, IIS)
- Pseudo Random Number Generator
- Real Time Clock
- Watch Dog Timer
- PG-TSSOP-38
- -40 - 85°C



2) XMC1202-T016X0016 AA (32-bit Microcontrollers with ARM® Cortex®-M0 with smart application oriented features)

Summary of Features:

- 16KB Flash, 16KB RAM
- 2.0 - 5.5V
- 4 x 16-bit timers
- 12 channel 12-bit ADC, 2 x parallel sampling
- 2 channel USIC (configurable to SPI, UART, IIC, IIS)
- LED brightness & color control module (BCCU)
- 2 x Comparators
- Temperature Sensor
- Pseudo Random Number Generator
- Real Time Clock
- Watch Dog Timer
- PG-TSSOP-16
- -40 - 105°C



Software: DAVE 3



8. Experimental results

The home automation system has been experimentally proven to work satisfactorily by connecting sample appliances to it and the appliances were successfully controlled from a wireless mobile device.

9. Project feasibility

The system can be easily integrated into an existing electrical system of a building thanks to its simplified design. Thanks to the way the wires and connections are placed, the user can enjoy the esthetic part. At the same time, the app's user interface is friendly to the customer, which helps him to enjoy the smart experience without any knowledge in the engineering field. Thus, the product is meant to be used by a broad spectrum of clients.

One of the trendy aspects of the project is the low energy consume. In this way, the system can be easily upgraded with a solar charger that delivers sufficient electricity to power it. In conclusion, the overall project contributes to the green movement. In other words it brings no harm to our beloved planet.

10. References

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