RC-5 PROTOCOL BASED EMBEDDED CONTROL SYSTEM FOR HOME SECURITIES

Hitesh J. Lad, Dr. Vibhuti G. Joshi

ABSTRACT

For better living, it is very important to pay attention to various aspects of life like securities, safety and comfort. Our home can be made secure in almost all respect using automatic embedded control system. The system provides security against burglary and various disaster conditions like fire, flood, cyclones, etc... In which control system continuously observes different parameters like temperature, smoke, wind velocity etc… and compares with the standard data fed to the system. If the system detects any abnormal condition then control systems works out the coordinate of the abnormality and alert users as well as pass on the information to the base control system for further action. The system can be constructed using embedded hardware with appropriate firmware program. The RC-5 protocol can be used to establish communication link between measurement/primary control systems to base control system.

Keywords: RC-5 Protocol, Embedded system, Base control system(BCS),Central Control System(CCS) Home security.

1. NTRODUCTION

Home security system provides safe-home against different disasters by measuring the different parameters at regular time intervals [2]. Home security systems is provide protections against abnormal condition like fire, burglars, etc… by automatically sensing abnormal condition and according to condition control system trigger alarm and send information to the base control system and according to particular information control centre generate commands for control devices which take appropriate actions and control the abnormal conditions. To serve all above aspects by system using RC-5 protocol and designed it in a such a way, it become flexible, programmable, relatively simple, and modular, so that new facilities can be added easily by small modifications in program and get efficient result of the entire system.

The rest of the paper is organizes as follows section-2 is detail information of RC-5 protocol and comparison with other IR-protocols, section-3 is discussed about details of the design and implementation, section-4 conclude the paper

2. PROTOCOL INFORMATION

“PROTOCOL is predefined rules which have to follow by every vendor tomake their product compatibles with different system environment”. Today most of

electronics systems used various remote control systems. these remote control system has different type of protocol which are used according to the applications/system requirements as for example RC-MM protocol, NEC protocol, Nokia NRC-17protocol, RC-5 protocol, etc…

A. RC-MM code[6]:

RC-MM code basic structure is shown below

Mode: 2-bit	Address 2-bit	Data 8-bits

Fig 2.1 RC-MM code Pattern

The 12 bit RC-MM code is the basic mode. First two bits are use for mod selection by which we select particular device families like keyboard, mouse and game pad, next 2-bits are address bits to select particular device from the chosen device family and 8 data bits are user command

B. NRC17-nokia protocol[1],[7]:

Pre-pulse	Start bit	Command 8-bit	Address 4-bit	Sub code 4-bit

Fig 2.2 NRC-17 code Pattern.

In NRC17 code first pulse is called the pre-pulse, and is made up of a 500µs burst followed by a 2.5ms pause, giving a total of 3 bit times. Then the Start bit is transmitted, which is always logic "1". This pulse can be used to calibrate the bit time on the receiver side, because the burst time is exactly half a bit time. The next 8 bits represent the IR command, which is sent with LSB first. The command is followed by a 4 bit device address. Finally a 4 bit sub-code is transmitted, which can be seen as an extension to the address bits. A message consists of a 3ms pre-pulse and 17 bits of 1ms each. This adds up to a total of 20ms per message.

C. NEC code[7]:

AGC burst	Address 8-bit	Inverse Address 8-bit	Command 8-bit	Inverse Command 8-bit

Fig 2.3 NEC code Pattern.

In NEC code message is started by a 9ms AGC burst, which was used to set the gain of the earlier IR receivers. This AGC burst is then followed by a 4.5ms space, next 8-bit are address which is then followed by 8-bit inverse Address. Next 8-bit is for Command which is followed by 8-bit inverse command; means address and Command are transmitted twice. The second time all bits are inverted and can be used for verification of the received message. The total transmission time is constant because every bit is repeated with its inverted length.

D. RC-5 PROTOCOL[1],[3],[4],[5],[6],[8]:

Start bit 2-bit	Control bit 1-bit	Address 5-bit	Command 6-bit

Fig 2.4 RC5 code Pattern.

The data packet structure for RC5 code is as follows:

1. □□ 2 start bits,
2. □□ 1 control bit,
3. 5 address bits,
4. □□6 command bits.

The start bits are always logic '1' and intended to calibrate the optical receiver automatic gain control loop. Next, is the control bit. This bit is inverted each time the remote transmitter releases the control command/informative command and is intended to differentiate situations when the remote transmitter continues to hold the same control command or repeat same command again.

The next 5 bits are the address bits and select the destination device. A number of devices can use RC5 at the same time. To exclude possible interference, each must use a different address. The 6 command bits describe the actual command. As a result, a RC5 transmitter can send the 2048 unique commands. The Transmitter shifts the data word, applies Manchester encoding and passes the created one-bit sequence to a control carrier frequency signal amplitude modulator. The amplitude modulated carrier signal is sent to the optical transmitter, which radiates the infrared light. In RC5 systems the carrier frequency has been set to 36 kHz. Figure 1 displays the RC5 protocol.

The receiver performs the reverse function. The photo detector converts optical transmission into electric signals, filters it and executes amplitude demodulation.

The receiver output bit stream can be used to decode the RC5 data word. This operation is done by the microprocessor typically, please note that the receiver output is inverted.

Compare to all the protocols listed above the RC-5 protocol is very much efficient because of the incorporation of the two start bits. This facility helps better synchronization. Control bit is also a part of the RC-5 pattern and used for the reorganization of the codes when the same pattern is repeated for more then one times. This in fact, each bit in RC-5 protocol pattern the timings are sufficient to recognize code bit status because of that we get the errorless information of address and command.

3. DESIGN AND IMPLITATION

Proposed Security model:

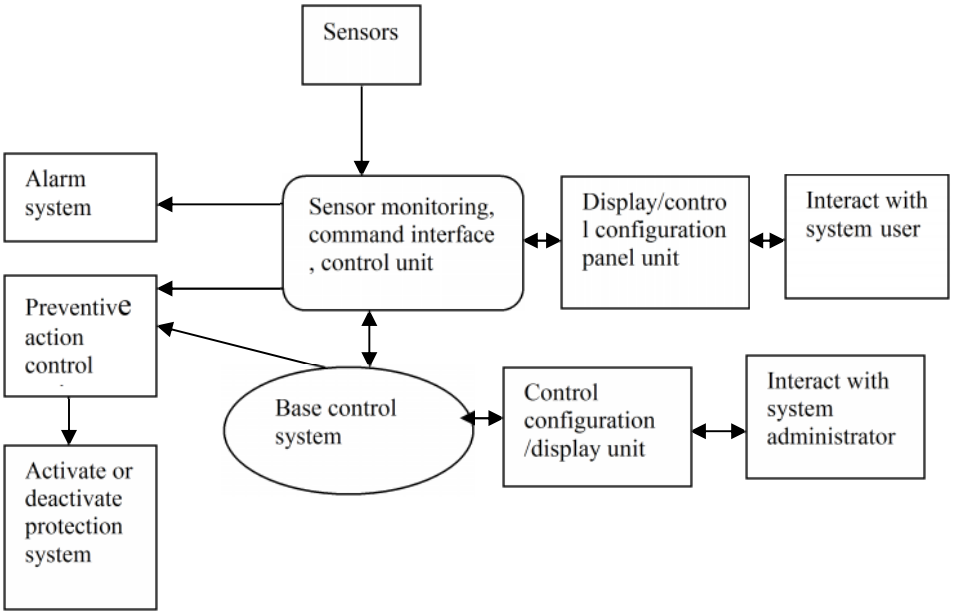

Fig 3.1. Model for home security

In proposed model sensor senses the temperature, smoke, pressure, etc… and produce analog electrical signal which fed to the control system where first of all signals are converted in to digital form using analog to digital convertor and then micro-controller in control system processes the data and compare with the preloaded values . Incase if the data do not match with preloaded value the interrupt is generated which not only trigger the alarm but also wake up the base control system for the further actions to control and handle the critical

condition. The degree of possible damage due to the disaster can be calculated by calculating the difference between the standard built in data and the data received from various sensors. If the harmfulness of the disaster found to be very high then the system warns for the intensive actions. The moment control system finds some abnormalities then the base control system ask control system to monitor and display the situation more sharply to monitor the rate of the growth of the damaging power of the disaster. Display and control unit purpose is providing checking facility for user and after checking condition if user is not find any abnormal condition then user can reset the alarm. At Base Control System side also one control configure and display unit which is use to give permission to system administrator to change measurement parameter critical value in the system and also provide the complete record of critical events and give the track of prevent /protection actions.

During normal condition interface/control unit continuously measure sensor values at regular time interval. It stores last 1 hour values and from those values minimum and maximum values are store in the memory. Base control system is generate query at regular interval [i.e.. At every one hour] and collect minimums and maximums values from control/interface unit. Intelligent devices inside the base control system will get track of the environmental conditions by analyzing last 24-hour collected values. After completion of analysis process base control system will decide which system requires more attention to reduce abnormality.

Different BCS systems can be interconnected by radio-wave communication channels with the help of TCP/IP based Zig-bee protocol in order to establish distributed wireless network. Wireless network connect with one centrally control system(CCS) which work as a gateway and it provide internet connection via a host PC and CCS also handle all network management task.

In the RC-5 protocol 5- address bits are use for addressing room or address particular special portion of the home like garden, porch, etc… means for room no-1 address is 00001 for kitchen address is 00010 for main door address is 00011. Next 6- command bits are allocate different command to particular condition/parameter, means smoke detection information command is 000001,command to generate smoke alarm by giving command 000010 to alarm circuit, if temperature goes beyond the preset temperature value high temperature detection command is 000011,to on water-shaver 000100,etc….

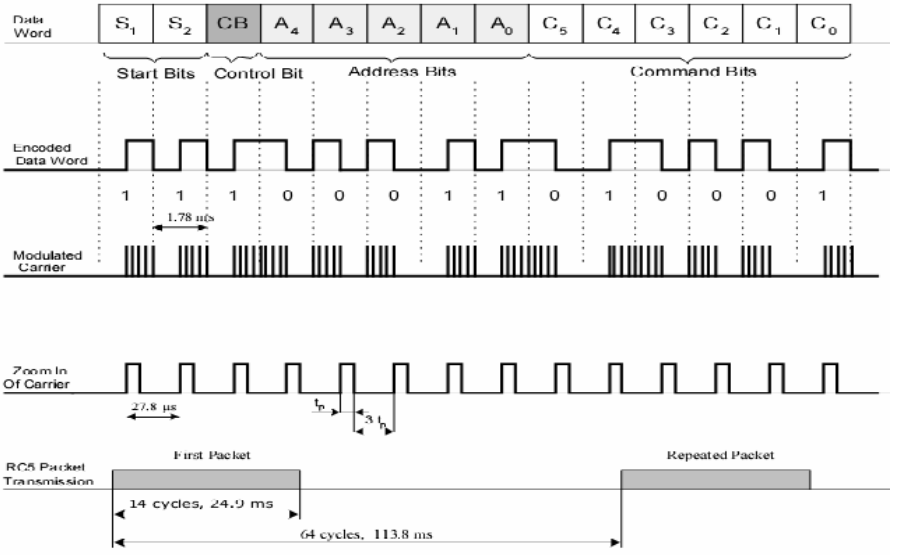

Fig 3.2 RC-5 protocol code pattern

If system find some abnormal condition in temperature at kitchen then by combining start bit-11 control-1/0 bit address bits-00010 and command bits-000011 control system transmit complete informative command-11000010000011 to base control system. Base control system decode the command and recognize the room location and condition abnormality type. On the bases of decoded information base control system takes preventive actions. In fire control system first detect smoke in room no-3 and fire control system send alarm command 11000011 000010 to the base control system. Smoke command information is decode by base control system and on the bases of the decoded information base control system send command 11000011000100 to fire control system to start water shavers system in the room No-3, unlocked/open doors and open the ventilators of the room number, this protocol also use to control some appliances from remotely like by using remote control, person can make room lights on/off, change fan speed, open/close garage Sutter, etc…

4. CONCLUSION

The System is designed, modeled and simulated on computer. The result of simulation indicates the perfect functionality of the system. Modular construction based Emulator of the system provide new feature and additional facilities embedded in the system which will be more user friendly and economic. The protocol efficiency in proposed model is limited to home applications.

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