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editorialsecretary.erjournal@gmail.com

DEVELOPMENT OF ARDUINO-BASED DOOR SURVEILLANCE SYSTEM: (A PILOT STUDY)

Nwobodo-Nzeribe HN[1], Nwankwo IJ[2]

[1]Department of Computer Engineering, Enugu State University of Science and Technology, Enugu, Nigeria.
[2]Department of Computer Engineering, Federal Polytechnic Oko, Anambra State, Nigeria

***Author for Correspondence:** nnenna.nwobodo@esut.edu.ng

ABSTRACT

Everyone wants to feel safe within their home and work environment. Over the years, home and office securities were achieved by employing watch dogs and security personnel to safeguard lives and properties. These methods worked for the time being but failed in some aspects as both the watch dogs and security personnel could be overpowered, drugged and even be hurt by these attackers. This pilot research work is aimed at developing a door surveillance system which will improve the security of homes and offices by capturing the image of the person at the door as well as triggering an alarm and then displaying the captured image in the television kept inside. The system was implemented using Passive Infrared Sensor (PIR) and an Arduino microcontroller with software assistance of Arduino IDE(Integrated Development Environment) and processing development environment required for its control. The wiring of the system in veroboard was done using its circuit diagram drawn and simulated in Proteus 6.0 environment. After soldering and packaging, the system was tested and the operation efficiency was satisfactorily. In conclusion, this system provided some solutions to security shortfall in our homes and offices as the image of the individual is captured and stored for future reference, without the person's knowledge.

INTRODUCTION

Over the years, home security was achieved by employing watch dogs and security personnel to safeguard lives and properties. These methods worked for the time being but failed in some aspects as both the watch dogs and security personnel could be overpowered, drugged and even be hurt by attackers (Meyer et al. 1996; Bing et al. 2001). However, security in our homes and offices can be improved upon by introduction of simple but smart advanced system and hence the development of this system.

This study aims to develop a door surveillance system designed to capture and display the image of individual entering the door as well as triggering an alarm to alert the presence of someone within the vicinity. The displayed image in the television inside reveals whether it is an intruder or not.

MATERIALS AND METHODS

The system is made up of the following hardware component-PIR sensors, HT12E encoder (manufactured by HOLTEK®), HT12D decoder (manufactured by HOLTEK®), RF 434 transmitter (Transcom® instrument), RF 434 receiver (Transcom® instrument), buzzer, relay module and Arduino Uno board programmed with C++, language (a human-readable programming language) that is executable in Arduino UNO board. The system algorithm used for Arduino coding was as thus stated: Start the system, image is captured, television is switched ON, alarm is triggered, and finally, system automatically switches off.

The systems circuit diagram was designed and simulated using Proteus 6.0. The Arduino board was connected to a computer through a Universal Serial Board (USB), where it was connected with the Arduino Integrated Development Environment (IDE). This USB transfers the data in the program directly to the Arduino board and was also used to power the Arduino. The Arduino code was written in the IDE, compiled and uploaded to the microcontroller that executed the code that interacted with inputs and outputs of the surveillance system. Arduino code is referred to as sketches. The IDE translates and compiles the sketches into the code that Arduino can understand. The receiver and transmitter section

was then developed, integrated and then packaged together on the Arduino Uno board.

The PIR sensor used in this project is basically a motion sensor or detector and captures any person that moves within the area under surveillance while the buzzer triggers an alarm in the receiver. The Arduino Uno microcontroller board based on the ATmega328P has 14 digital input/output pins (of which 6 can be used as Pulse Width Modulation (PWM) outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button (Jun et al. 2011). An encoder is a device used to change a signal or data into a code while the code may serve any of a number of purposes such as compressing information for transmission or storage, encrypting or adding redundancies to the input code, or translating from one code to another. A decoder is a device which does the reverse of an encoder, undoing the encoding so that the original information can be retrieved (Lit et al. 2011; Sivagamasundari and Janani, 2012).

Block Diagram of the System

This work consists of two sub-systems which include the transmitting and receiving units respectively. When the system is switched on, the transmitter's red light (mounted at the door entrance) and the receiver green light (mounted inside the house) glows. When someone comes to the door to strike the door, the image is being captured by the camera and the receiver's buzzer triggers an alarm and the relay. The relay then switches on the camera outside the house and the television inside the house to capture the image of the person outside the door. If the television is already switched on, only the camera will be switched on. Once the person enters through the door or leaves the vicinity of the system, the buzzer and the camera turns off.

The block diagrams of the transmitter section and receiver section are as shown in figure 1 and figure 2 respectively below.

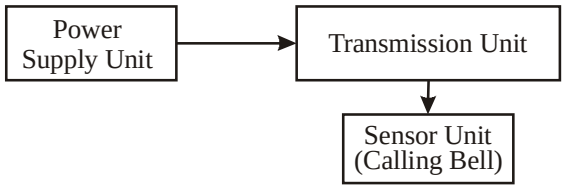

Figure 1: Block diagram of the transmitter section

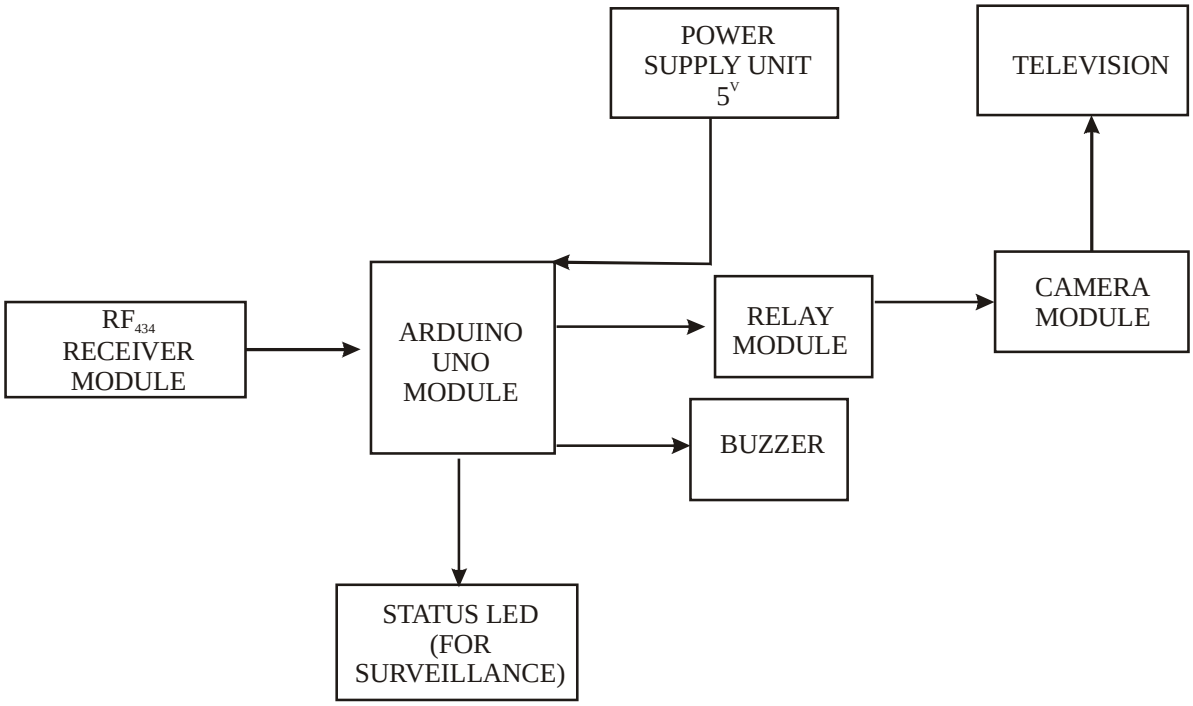

Figure 2: Block diagram of the receiver section

The transmitter circuit utilizes the radio frequency (RF) module operating a wireless remote, which is used to drive an output from a distant place. The RF module uses radio frequency to send signals which is transmitted at 434 mHz. Encoder IC (HT12E) receives parallel data in the form of address bits and control bits. The control signals from remote switches along with 8 address bits constitute a set of 12 parallel signals. The encoder HT12E encodes these parallel signals into serial bits. The transmitted signals are received by the receiver module mounted inside.

The receiver module receives serial input and sends these signals through pin2 to the decoder. The signal is received and decoded by HT12D decoder module of the controller. The decoders receive data that are transmitted by an encoder and interpret the first N bits of code period as addresses and the last 12_N bits as data, where N is the address code number.

RESULT AND DISCUSSION

The circuit diagram as shown in figure 3 was used to produce a prototype as shown in figure 5. Figure 4 shows the implementation and wiring of the circuit diagram in the veroboard.

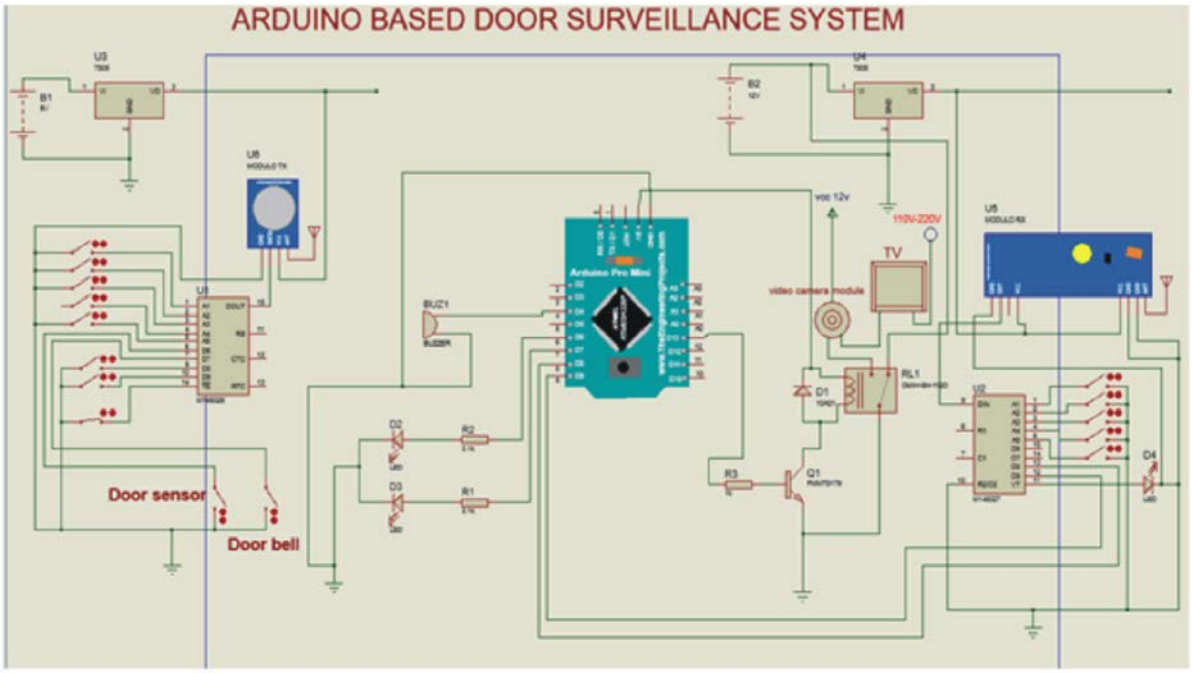

Figure 3: Circuit diagram of the system

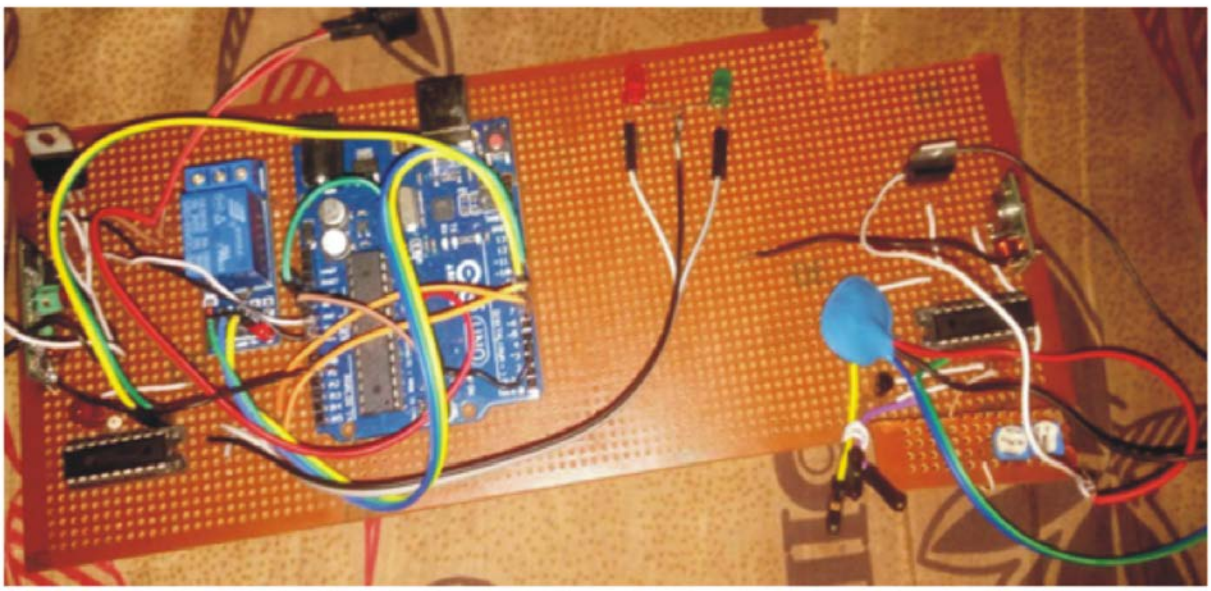

Figure 4: Wiring of the system in a veroboard of the system

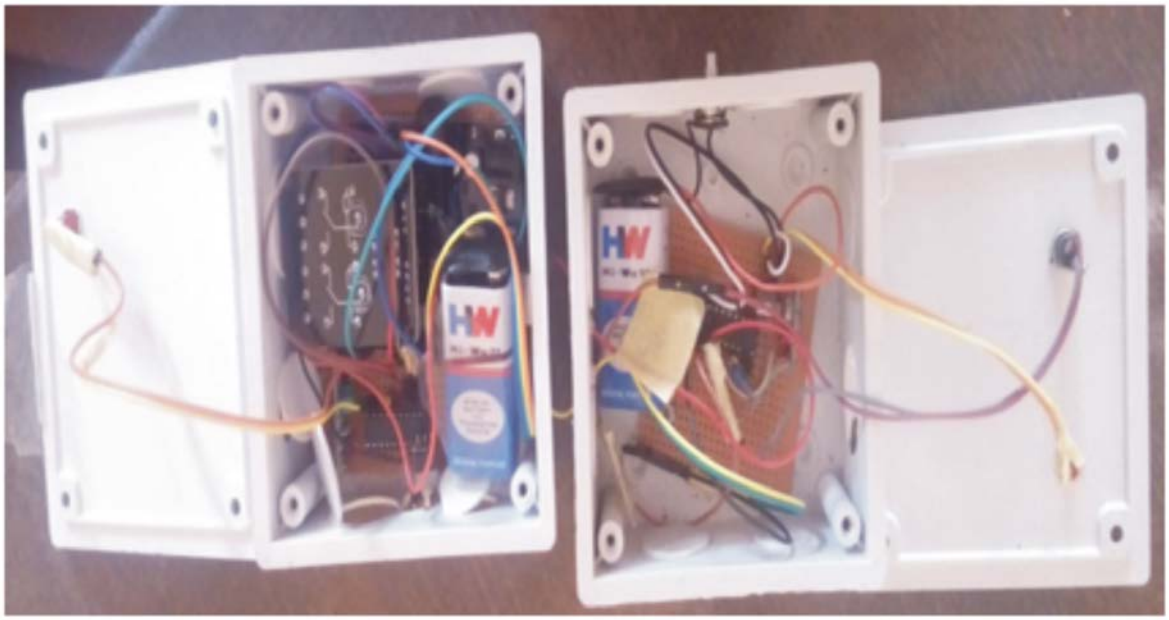

Figure 5: Prototype of the system

The result from this research work increased the security of home and offices by capturing the image of the person at the door, triggers and displays same in the television kept inside the house.Comparing this with watch dogs and security personnel usedover the years to safeguard lives and properties, these methods failed as they could be overpowered, drugged and even be hurt by attackers (Meyer et al. 1996; Bing et al. 2001). In recent times, other door surveillance systems have been developed but instead of image capturing as shown in this pilot research work, they utilized the use of password and biometric method for their securities respectively (Jun et al, 2011; Sivagamasundari and Janani, 2012).

CONCLUSION

A highly technically advanced security system for residential and business area has been developed. However to ensure improvement of the system, there is need to provide a database for storing the videos of captured images. This project provided some solutions to the security shortfall in our homes and offices.

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