Development of Motion Triggered Image Recording System with Ov7076 for Home Security

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Abstract—There is vast need for an improved house security system to overcome house incursion problem when user is not in house. There are many types of house security system which is too expensive and difficult to use. For that reason, an effective house security system at low cost is proposed in this work. This paper focuses on development of motion triggered image recording system using Ov7076 camera for home security which is controlled centrally by microcontroller. The complete project is divided into two parts. The first part is concern on hardware development. Infrared Motion detector and Ov7076 camera were the input components while the SD Card is the image storage unit. The second part is based on software development to operate the hardware. The infrared motion detector is capable of detecting motion while the microcontroller coordinates the system operation. The developed system was tested to be effective.

Keywords: camera, detector, home, microcontroller, security.

I. INTRODUCTION

Security describes protection of life and property. Home security has been of wide-reaching concern. As the technology is emerging every second, ample home based security systems have been developed and implemented to keep home safe. Home security system is an essential means of protecting home from illegal incursion. Camera captures video in 24 hour to identify what goes on around the house and in the house as well as get a hold of the evidence if there is a house breaking around the captured areas. Burglar alarm acts as the tool to alert the house owners and their neighbors. Motion detection is the action of sensing physical movement in a given area [1]. Motion can be detected by measuring change in speed or vector of an object in the field of view. This can be achieved either by mechanical devices that physically interact with the field or by electronic devices that quantifies and measures changes in the given environment [2]. There are two devices of motion detection: mechanical device and electronic device. In the mechanical device, a tripwire is a simple form of motion detection. If a moving object steps into the tripwire's field of view then a simple sound device like bells may alert the user. Mechanical motion detection devices can be simple to implement while in electronic device, the electronic motion sensing such as motion detectors, can prevent such mechanical intervention [3]. The principal methods by which motion can be electronically identified are optical detection and acoustical detection. Motion detection devices, such as motion detectors, have sensors that detect movement and send a signal to a sound device that produces an alarm or switch on an image recording device.

There are motions detectors that employ cameras connected to a computer which stores and manages captured images to be viewed over a computer network [4]. However, the demerit of this is possibility of power failure and durability. The applications for such detection are detection of unauthorized entry, detection of cessation of occupancy of an area to extinguish lighting, and detection of a moving object which triggers a camera to record subsequent events. The motion detector is thus a basic idea of electronic security systems [5]. The basic design of a security system begins with analyzing the needs of the inhabitants, surveying existing technology and hardware, reviewing system costs, considering monitoring choices, and finally planning the installation. In addition to perimeter and interior protection offered by a security system, surveillance monitoring includes features that enable the inhabitants to observe environmental conditions inside and outside the home when at home or away [6]. In a home surveillance system, video cameras and display systems are considered by most contractors to be optional items. Subject to the homeowner’s choice, surveillance equipment can function independently from the basic features included in home security monitoring [7].
The home security recorder (HSR) has lots of beneficial effects on society. Its social impact will be very important, because people being far away from their home need not to be worried about it. People will be able to watch their home [8].

The Design Objectives

a) It provides protection of home and family from intruder.
b) It is to provide household with peace of mind at lesser cost compare to similar previous technology.
c) It enables user to have gestalt of their home or properties in their absence.

II. THE STUDY

Home security systems allow for homeowners to secure less frequented areas of the home such as the basement and the garage. This makes it more difficult for intruders to take their preferred methods of entry into the home and go unnoticed. Home security systems mean that homeowners do not have to depend upon neighbors to watch over their home when they are away [7]. There is less chance of human error with electronic system. Security systems not only protect family and possessions, but they also provide protection for pets [9]. Figure 1 illustrates basic structure of a camera embedded security system.

![Descriptive block diagram of the system](image)

Figure 1. The descriptive block diagram of the system

Motion detector

A motion detector is a device that contains a motion sensor and is either integrated with or connected to other devices that alert the user of the pre-sense of motion. An electronic motion detector contains a motion sensor that transforms the detection of motion into an electric signal. The electric signal can be connected to a Burglar alarm system which is used to alert the home owner or security service after it detects motion [6]. Active Sensors in motion detectors system are commonly used inside homes for a security system. An active motion detector emits optics or sound waves and measures feedback to detect motion. The simplest type of active motion detector is commonly used in commercial doorways to trigger a doorbell [4]. A device is fixed to one side of the doorway, an optical sensor to the other. A beam of light will passes from the device through the sensor. When someone enters the establishment, the beam is broken, triggering the detector, camera (input) and SD-card storing (output) devices. For that reason, active motion detectors can be purchased for home improvement security system [10]. It is an inexpensive device that can add for more security to a home and provide peace of mind for home owners.
III. MOTION DETECTION AND RECORDING TECHNIQUE

The proposed development of motion triggered image recording system with ov7676 for home security system, Figure 2 and 1, is of two parts: the hardware and software. The hardware parts are detector, camera, RAM or SD-card storage (Figure 3) and processor (Figure 4) unit. The inputs stage of the security system is the motion detector circuit, camera module, and magnetic sensor. The second stage is the controller unit which is the PIC18F45K22. The purpose of using microcontroller is to control the whole system operation by sending data to the output stage which is the SD Card which record and stores the motion or event that occurs in your home.

A. THE SYSTEM HARDWARE UNIT

![Figure 2. The design system block diagram.](image)

**Secured Digital (SD)**

The used ultra-small flash memory card designed to offer high-capacity memory in a small size. SD card are engaged in many small portable devices such as digital video camcorders, audio players and mobile phones [11].

![Figure 3. The picture image of an SD card socket.](image)

**Microcontroller (PIC18F45k22)**

It is a high performance RISC CPU; which uses C compiler optimized architecture instruction set and has data EEPROM to 1024 bytes linear program memory addressing to 64 Kbytes.

![Figure 4. The picture image of the microcontroller pins.](image)
**Ov7076 Camera Module**

The Serial Camera as shown below is a JPEG color camera module with DSP image processing to generate 320 by 240 or 640 by 480 JPEG image, picture stored in internal buffer and transferred via UART port. This unit will capture obstacle area by instruction of Arduino controller.

**Motion detection unit**

The detector unit consists of two housings. The first housing contains an infrared-emitting diode and an infrared-sensitive phototransistor as the infrared detector. The other housing contains an infrared reflector to reflect the infrared signal. When positioned in front of an entrance to a protected area, the two housings establish an invisible beam. A person who enters the area will interrupts the beam causing an alarm to be triggered. For this type of motion detector uses the basic concept of the active infrared motion detector. An interruption in the signal modulated pulsating beam transmit by an infrared diode while receive by an infrared detector will set ‘on’ or ‘off’ the alarm of the security system.

The integration of electronic components of the developed system is as shown in Figure 5. Each component was studied connected properly as shown. The hardware development of the active infrared motion detector system is divided into two parts, which are the infrared emitter circuit and the infrared detector component.

![Figure 5. The system design schematic diagram.](image)

**Motion detector circuit**

In designing the home security recorder, the motion detector circuit, it is based on two basic principle of active infrared motion detector which is the infrared transmitter and infrared receiver.

**Infrared transmitter or the emitter**

For the infrared transmitter which is also known as emitter circuit, it is on a basic design of timer 555 a stable operation. The output of timer is connected to the infrared transmitter is used to create pulse using and a stable timer circuit. In a stable circuit operation, pulse will repeatedly be produced until the power supplied through the circuit is removed. The stable circuit produces a continuous train of pulses at any essential frequency. This means that the 555 timer can operate repeatedly; it will switch on and off continually to generate data for the infrared transmission.
The emitter, Figure 6, circuit was built. A probe or the oscilloscope is attached to the infrared LED while the adjustable resistor is varied to standardize the emitter.

![Emitter Circuit](image)

**Figure 6. The emitter circuit.**

**Infrared Receiver**

The infrared receiver which is also known as infrared detector receives the data transmitted by the infrared transmitter circuit. It is a simple electronics device on detecting infrared signal. This infrared detector can be directly connected into the controller circuit to produce logic high or low from the output terminal thus activate or deactivate the controller system operation. The range of infrared detector components according to datasheet stated that the infrared detector can fully operates on detecting the infrared signal of 38 to 45 kHz.

There are four major modules in developing the hardware structure which are the Motion Sensor, Camera Module, Arduino Mega Board, and SD Card module, and the most importantly; the arduino mega board, Figure 6.

![Arduino Uno](image)

**Figure 6. Arduino-unor open-source microcontroller**

**The System Principle of Operation**

When the motion sensor detects movement of an intruder(s), it sends an alert to the Arduino microcontroller. The microcontroller will enable the camera module to take the still picture of the object. The still image will then be saved to the SD card by the microcontroller.

**B. The Software Development**

The order of programming the controller is as shown in Figure 7.
IV. RESULTS AND TESTING

The proposed systems are tested on the model of smart home. The camera detects the motion and then record and stalls still picture to the SD Card. The system is very simple and easy to use. There are various parameters which can be adjusted in this software. Streaming of videos is also possible with this software. The developed home security recorder system gives good response to the sensor and record the motion when it detects. The time taken by the system to detect and record is dependent on the coverage area or range of the specified camera. If the camera is in the range of the system then the recorder is conveyed in 20-40 seconds.

**Testing**

It is of paramount importance to establish a highly efficient testing technique in other to minimize cost. The testing instrument used for examining logical signal, testing and troubleshooting application in the course of this project were: digital multimeter, logic probe and oscilloscope. Testing involves troubleshooting the hardware system to detect, isolate and correct internal or external fault such as malfunction in the internal circuitry, input or output shorted or Vcc input or output open circuited, short circuit between two pins broken wire, poor of dry connection, bent or broken pins, or an IC and faulty ICs socket.
The hardware system was properly tested because the software cannot work without the proper functioning of the hardware. The testing of the entire circuit was carried out in stages:

i. Each of the components was first tested using the multimeter in order to check for their state of performance and accurate values.

ii. In the connection, each component on the veroboard was then tested. This was done in order to carry out the continuity, which is meant for proper connection of the circuit and to detect any wrong connection.

iii. The sensory unit circuitry was tested to ascertain the degree of sensitivity.

Packaging

After proper testing was conducted, the packaging (as shown in Figure 8 and 9) of the design into a model and casing was considered. The connecting wires were properly connected and well insulated; also the wires were well packed and bounded together.

![Figure 8. Veroboard Implementation of the system.](image)

![Figure 9. Package prototype of the constructed system](image)

Applications

This project has its main application in security system. This project can be used in home domestic security system. It can be used in the house for theft detection in the absence of the user. With the use of this system, human life and properties can be saved. As the system is SD Card based, there is no need to have extra circuitry to record. It is very cost effective, as day by day the cost of SD Card is reducing.

Future scope

The future implications of the project are very great considering the amount of time and resources it saves. It can be improved further to store streaming video and send it instantaneously to the user through electronic mail.
V. CONCLUSION

The intentions of this work have been attained by developing motion triggered image recording system with OV7076 for home security system, the conservatively 'human-watch' and usage of dog barking to create awareness or alert at home all the time can easily be replaced with this less expensive device, once the device is installed at the watch target. A more effective and sensitive sensor is recommended for better performance. This work can be advanced to sending the recorded image into the user's email instantaneously as soon as the motion is detected so that the user can see the footage anywhere in the world with telecommunication network coverage.

RECOMMENDATIONS

This design is recommended for use in offices and organization because of the low initial cost outlay. It is recommended for home users as a means of securing their home and property in case of any intruder and for government establishment or agencies. Motion triggered image recording system with OV7076 for home security is also useful device for Bank and other financial institutions.

REFERENCES