

Full Length Research Paper

Design and development of an advance burglary detecting system

*Emeyazia, I. D., Obonyano, K. N., and Aki, A.

Department of Computer Engineering Technology, Delta State Polytechnic, Ozoro, Nigeria.

*Corresponding Author E-mail: princesdlando@gmail.com

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ABSTRACT: This project involved the design and construction of a microcontroller-controlled burglary detector with an alarm and a taser device. To optimize its performance, this advanced security system made use of both electronic hardware and software. The microcontroller chip and the Assembly language used to program the microcontroller chip coordinated the hardware components. The role of the microcontroller unit in an embedded system was to provide low-cost programmable logic control and interfacing to external devices. The operation of this burglary system was straightforward. When the intruder was discovered, the

alarm system was activated, as was the taser device. These actions will not only alert the residents of the area, but will also immobilize the intruder until he is apprehended. An experimental trial on the device revealed that it is 90% efficient at night and 80% efficient during the day. The advanced security system will provide a dependable means of protecting people and property from intruders.

Keywords: Alarm systems, intruder detector, robotic, security system, taser device

INTRODUCTION

Insecurity has become a global issue; thus, combating the global insecurity situation has become a major task for the governments of various nations. One of the major challenges to combating crime around the world is a lack of necessary workforce and equipment to combat the growing number of criminals in society. This is because most modern criminals are well-armed and use advanced techniques to carry out their heinous acts. As a result, there is an urgent need for the development of advanced systems to combat the growing number of criminals in society. According to Crosbie and Eugene (1995) more sophisticated measures have been developed to ensure an intruder proof environment due to advanced techniques used by intruders that outsmart old security measures. Ford automobile company designed and developed an automated police vehicle that employs artificial intelligence to detect and arrest traffic law violators (Fritsvold, 2020). Diego (1996) designed and built a security system that detects intruders' movements as soon as they walk or move within the radar range of the system. The use of burglary detection systems is increasing nowadays, particularly in commercial and

private properties (Ahmed et al., 2006). According to Kaufman et al. (1995) a burglar alarm system is an electronic device designed to alert the user and the surrounding community to a specific danger. Sensors connected to a control unit via low-voltage wiring or a narrow band RF signal used to interact with a response device was used in the device. Some of the most common security sensors are passive infrared (PIR) sensors used to indicate the opening of a door, window, or detect motion; and microcontrollers, which are small computers on a single integrated circuit that contain a processor core, memory, and programmable input/output devices. All alarm systems have four main component areas: detection devices, which detect if an intrusion has occurred (Anderson, 1980); warning devices, such as bells, sirens, and remote monitoring (Ramesh, 2003); control panels, which control the various states of the system (Rizzoni, 2003); and power supplies, which include backup batteries (Theraja and Theraja, 2003). On-chip program memory in the form of NOR flash or OTP ROM, as well as a small amount of RAM, is sometimes included. Microcontrollers, as opposed to

microprocessors used in personal computers or other general-purpose applications, are designed for embedded applications (Tozzi, 1988). Before you add any special technological components, there are three simple do-it-yourself steps you can take to create a home intruder system. These steps are as follows: Install exterior lights with either a timer or a motion detector, another step is to secure all exterior doors and windows with well-built, sturdy locks, and another step you can use is to trim back trees and shrubs in your environment or house, especially around windows and doors, some home intruder system tasks are simple and quick projects, but they provide you and your family with the necessary security (Rebecca, 1997). Despite the fact that several burglary detection systems have been designed and developed by various authors (Viola and Jones 2001; Ahmed et al., 2006; Antunes, 2007), there is no recorded literature of a burglary detection system that is equipped with a taser device. As a result, the goal of this research is to design and develop an advanced intruder detection system, complete with a taser device, that will not only detect the presence of an intruder, but will also immobilize him/her pending arrest.

Design methodology and system analysis

The approach adopted is the prototyping. This is because it helps in typical actualization of the study design, which can be done quickly and easily. A block diagram has been developed to describe the operation of the system (Figure 1).

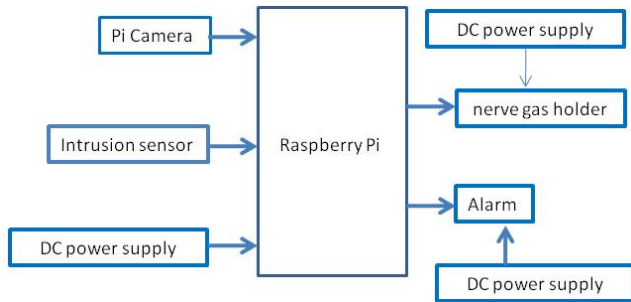


Figure 1: The system block diagram.

System design

The design and development of this security device has two basic parts, namely: the hardware and the software parts. The software requirement is the assembly language hex code necessary to enable the microcontroller to control the operations of the hardware units. The software design was developed using the basic principles of first drawing out the flow chart before

writing the source code. The source code for the microprocessor was written in assembly language (Figure 2). Assembly language was chosen because the behavior of the hardware is well known and assembly language (very close to machine language) encourages direct communication with the underlying hardware (Ilgun, 1993). The major hardware used for the development of this device is the: Raspberry Pi 3 Model B+, Raspberry Pi Camera Module V2, alarm device, intrusion sensor, robotic arm and taser device.

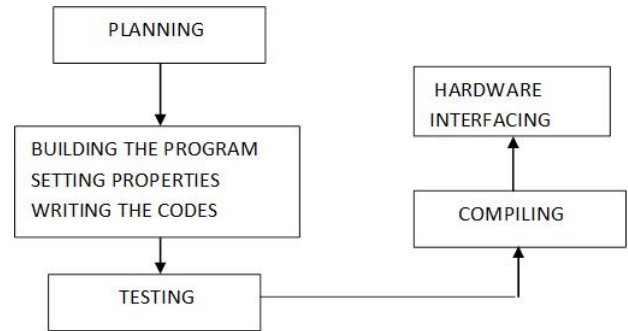


Figure 2: System block diagram.

System workflow

The system detects the presents of the intruder with the aid of sensor, while the vision system detects the location of the intruder. The sensor system consists of proximity-motion sensor designed with a 555-timer integrated circuit. The intelligence of the sensor depends on the ability of light dependent resistor (LDR) to vary its resistance in responds to changes in the intensity of light in an environment (Electronics, 2020).The circuit is implemented in such a way that an output is generated whenever the ray of light which is illuminating the LDR is obstructed. This output is now fed to the microcontroller for proper processing of the input data (Sensor, 2019). The circuit for the sensor circuit is shown in (Figure 3). During operation, once the human body sensor detects the presence of an “unwelcomed” third party, it activates the alarm system that will trip on automatically. This will continue for a pre-set period of time, before it will goes off. The output section consists of active transistor powered sound transducers (loud speakers). The system was designed in such a way that the output of the microcontroller was first amplified by an NPN bi-polar transistor before been fed to the loud speakers. The circuit diagram of this sub-system is shown in (Figure 4). As the alarm is on, the Raspberry Pi camera will scan the whole area and established the spatial position of the intruder. Once the precise position of the intruder has been established, a taser device attached to a robotic arm moved it into position. Then the taser device is activated, and a pre-set dose of electrical waves (electric shock) are

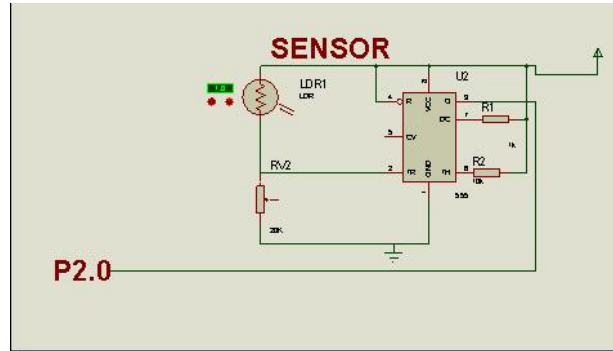


Figure 3: A sensor circuit diagram.

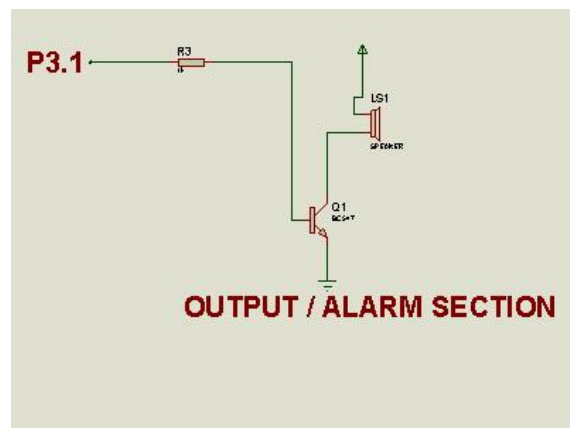


Figure 4: The output section circuit diagram.

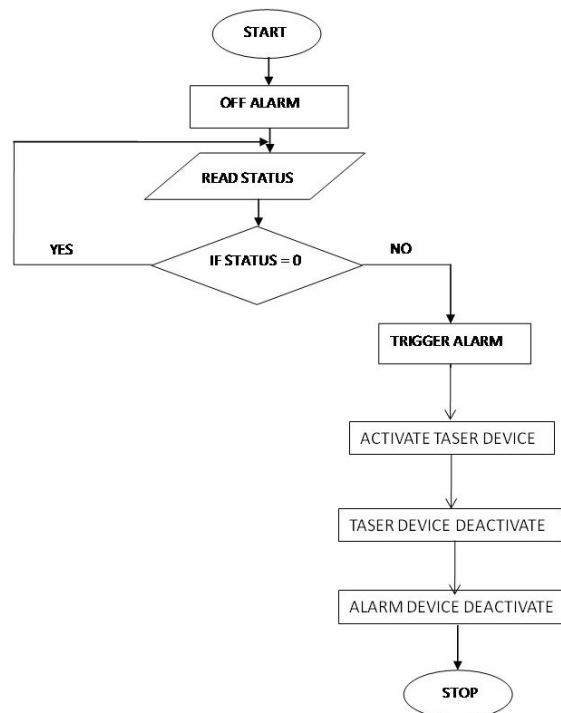


Figure 5: System flow chart

ALGORITHM

STEP1: START
 STEP2: Off alarm
 STEP3: Read status
 STEP4: If status = 0 go to step 2, else go to step 5
 STEP5: Trigger alarm
 STEP6: Trigger taser device
 STEP7: Deactivate taser device.
 STEP8: Deactivate alarm device
 STEP9: End

Table 1: Performance rating of the security system

Time	Success	Failure	Performance rate (%)
Day	8	2	80
Night	9	1	90

sprayed directly on the intruder, to incapacitate the intruder. After each operation, the system will reset automatically awaiting the next operation. The unique feature of this security system, compared to existing burglary detecting system, is the incorporation of the taser device. The architectural structure of the security device is shown in the flowchart presented in (Figure 5). Likewise the ALGORITHM of the system is shown below.

RESULTS AND DISCUSSION

The security system was tested 20 times, 10 times in the day times and 10 times during the nightfall. For safety reasons during the trial period, the taser device was replaced with water toy gun. Results obtained from the trial test are presented in (Table 1). As results revealed by the results, the device performed better in the night (90% efficiency), than in the daytime (80% efficiency). The superior results obtained during the night could be ascribed to be lower environmental temperature.

Conclusion

This study was carried out in order to design and develop an advanced burglary detection system. The study proposes a simple method of protecting people and property by utilizing robotic technology, remote controls, object detection, and sensing devices. The experimental trial results revealed that the system not only alerts users and their neighbors to the presence of an intruder, but also immobilizes the intruder. The system revealed automation and the unique role microcontrollers can play in ensuring man's comfort and satisfaction. The system ensures a dependable and inexpensive means of monitoring an environment at a very low cost.

Recommendations

- (i) It can be modified and applied to achieve

surveillance and monitoring of environment.

- (ii) Solar or renewable energy should be used to replace the non-renewable batteries.
- (iii) The government and other appropriate authorities should sponsor and encourage research in the field of digital system because it has the potential to improve our world and make us the technological-giant that we would all be proud of.
- (iv) This field has the potential to open new doors in our quest for industrial revolution and create numerous opportunities for our teeming youths and potential work force.

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