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MODERN ALARM SENSORS FOR SECURITY SYSTEMS

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ABSTRACT

The simplest definition of a security system is implied by its name: it is primarily a method or mechanism by which everything is protected through a network of cooperating components and devices. Since there are so many robberies and kidnappings around the world, it is now possible to protect people's lives, businesses, schools, and homes by using alarm security systems that will monitor, guide, and guard against intruders. The stability of international relations as well as the advancement of any civilization's or nation's economy are under jeopardy as the world population grows. To address such issues, it is imperative to create useful technologies that will protect human life. In this essay, I will discuss the security alarm system literature, the various types of sensors used in security systems, technological advancements, the drawbacks of installing security alarm systems, and the advantages of installation for security because the majority of the papers I read did not address the significance of installation for security purposes.

Keywords: Modern Sensors, Abduction, Alarm System, Burglar, Security.

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INTRODUCTION

The security alarm system also provides a fantastic way to support and assist various demands of people with disabilities, particularly elderly people or persons with specific illnesses who are unable to move around in homes, offices, or other public spaces. Even in the future, the number of users of home

automation and the sectors in which it is used will continually grow. A home or area that is connected to technology and services through networking to keep an eye on the area that needs to be guarded and improve people's quality of life is typically described as having a home automation system or security system. In order to improve comfort, ease, security, and efficiency, a security alarm system or home automation consists of centralized management of lights, appliances, temperature, and other systems. From the perspectives of security and accessibility, this study provides an extensive explanation of numerous security automation systems and technologies [17, 21–24]. Home security should be of the utmost importance to everyone who owns or leases a home. Every person deserves a home that is secure and safe. However, the majority of security solutions on the market are either expensive or dangerous. Security systems and security equipment frequently have a variety of openings that can be easily exploited. When you look at your family and house, the first thing you want is their protection [19]. And then the concept of an integrated system of home protection comes into play [12]. Since the late 1970s [7], the idea of home automation and its safety have been around. But our perceptions of home have changed a great deal over the course of time with the advancement of technology, as has the concept of home automation and its security system. If we look at different home automation systems over time, we can see that they have always attempted to give homeowners dependable, simple, and secure means to access their houses. Today, IoT [5, 6] is growing with a variety of apps in many industries, including the security and surveillance sector. A network of connected physical items that can communicate and exchange data is known as the Internet of Things (IoT). Building systems using a combination of hardware and software technologies that can operate remotely without any person being involved or monitoring has become possible thanks to recent technological breakthroughs [5, 6]. We can employ IoT technology to create a cost-effective and effective security automation system. The available systems are either expensive or proprietary, making it impossible for a user to afford them, or they are tied to a single provider, limiting their options and preventing them from investing in the necessary security infrastructure. Security and communication capabilities can be integrated into IoT-based intrusion detection systems to warn the intruder's owner even before the intrusion and prevent property damage. The development of technology capable of identifying potential dangers, such as persons or vehicles approaching them, has been assisted by the increased focus on the perimeter protection of national properties, both at home and abroad. In order to construct a flexible and reliable gadget, it is interesting to integrate a variety of sensors, each with unique modalities and detecting ranges. They suggest a system based on three security sensors that have proven effective at identifying and categorizing security threats. These sensors include earthquake, vibration, and acoustic ones [8]. The 'Smart Fence' device based on these sensors will be especially useful for the identification and reporting of successive approaching occurrences, such as an approaching vehicle [9-11, 14] with passengers seeking to breach a gated facility. For instance, long-distance vehicles might pose less of a hazard than intruders breaking into a secure area, who might pose less of a concern than invaders trying to scale a fence around the area. The auditory signals of interest generated by approaching people and moving vehicles are complex. They recommend utilizing a neurobiology-inspired algorithm to identify incoming cars and categorize the different kinds of vehicles. Unsupervised learning is carried out via nonlinear Hebbian learning (NHL), a straightforward and enticing neural learning mechanism inherent in the human brain, although the precise acoustic signature is unclear. Light track, heavy track, and motorcycle vehicle types can all be distinguished by the established system. The goal of a seismic-based human danger detector is to discern approaching humans and to discriminate between a single vibration event, such the falling of a tree limb, and a sequence of vibration events created by the animal and the history of passenger cars. The sensor employed was a geophone-based seismometer, which is a low-cost sensor capable of long-range detection and easy deployment. Gaussian mixture models were created in order to represent the statistical characteristics of the temporal gait and frequency features that were derived from the seismic signals. The apparatus was set up to discriminate between footfalls from people, vehicles, and backdrops. For the purpose of identifying and categorizing fence breaches, a 3-axis accelerometer has been deployed. The developed algorithm based on a non-homogeneous Markov model is able to identify the type of breaches, whether they are the result of a human climbing on the fence or the rattling brought on by a strong wind. The suggested algorithm and apparatus have been tested on several fences and have demonstrated robust recognition for differentiating between climb, kick, rattle, and context. We came across a number of systems while building the intrusion detection system. The Arduino-based Wireless Motion Detecting System [1] uses the Arduino UnoR3, ESP8266 NodeMCU Wi-Fi module, alarm, Red Light Emitting

Diode (LED), and PIR Sensor [pir]. Software known as Android Studio 3.1 was employed to create this device foundation. The device application was written in the Java programming language. Similar to how an alarm system is used, data is transmitted to the consumer. Applications that have been imported to users' cellphones may set off an alarm if the alarm device detects movement. The system relies on a server-based strategy, which ties the user to the Internet. The Radio Frequency Identification (RFID) technology [13, 15-16] from the e-KTP is employed as the foundation of the home security system employing the Arduino Uno microcontroller as a doormat in the door-based digital home protection system in the 'e-KTP. When the power is turned on and an e-KTP card is present, the data contained on the card will be transferred to the RFID Reader. In the event that the check is unsuccessful, an alert, a threshold warning, and the activation of the red light will be produced to signal that a robbery has taken place inside the structure. A XAMPP server was used to create a database for e-KTP online. To detect unauthorized attempts to access secure areas and to alert security response teams to such efforts, intrusion detection systems employ a variety of sensors. The main sensor technologies for interior safety are passive infrared (PIR) sensors [18], proximity sensors, microwave sensors, video detectors, and magnetic switches. Since most invasions result in vibrations, which can be felt to build a detector, another type of sensing is used in this paper. When the unlawful movement of protected objects can be detected using the vibration caused by the attack, the suggested sensor may also be employed for tamper detection. Since no sensor wiring or cabling is required, wireless sensors are more comfortable to deploy than their wired counterparts. For wired detectors, power may be supplied with ease; however, this is not the case for wireless sensors, and power efficiency is a crucial design consideration. A sensor's power consumption will be reduced via duty-cycling, which uses a short period of operation followed by a longer period of inactivity to conserve electricity. More energy can be saved during sleep than during awake time, the longer the sleep period. Sensors must stay awake for a certain amount of time in order to sustain their sensing capabilities. In this study, a novel sensor with low-cost MEMS accelerometers and a straightforward mechanical system is described, extending the sensor's capabilities to low-energy operation. Duty-cycling requires that the interval between two sensor awakenings be trivially shorter than the duration of the event to be detected. This fact limits the possible duty cycle, assuming an event occurs. The proposed system uses vibrations to detect unauthorized efforts, hence it is important to consider how long each act would cause a vibration. However, in our suggested method, we apply a hardware extension of the sensor, which extends the impact of the event in time and permits shorter duty cycles and reduced energy usage. The novel energy-efficient MEMS accelerometer-based sensor that is suggested in this paper can be employed as a temperature or intrusion detector. The sensor is built on a cheap BMA180 accelerometer with a straightforward mechanical modification that lengthens time events and, as a result, reduces duty cycle activity. With repair cycles as short as 5-10%, the suggested sensor performed incredibly well in performance testing (100 percent hit rate). The sensor can be utilized in wireless (like ZigBee) networks because to its low power consumption. A network of interconnected things that can communicate and exchange data is known as the Internet of Things (IoT) [5, 6]. The creation of systems that can operate remotely without requiring human intervention has been made possible by the convergence of hardware and software advancements. Around the world, theft and burglaries are increasing exponentially. Such occurrences, which take place when the house's residents are not home, have been covered by a number of news publications. Even when occupants are present, burglars frequently enter through open doors. All people have to deal with this conundrum. Consumers cannot afford the available solutions because they are either too expensive or too proprietary, or because they are compelled to remain loyal to a single vendor, which limits their options and prevents them from making the essential security infrastructure investments. To address these problems, the article suggests a low-cost, scalable, and low-maintenance intrusion detection system. The proposed device would not function like any of the protection devices that are currently on the market, which do not alert the customer when an incursion takes place. This device does not generate any false alarms because it alerts the user when a disruption occurs. The hardware module and a mobile application make up the framework. The hardware module alerts users of the app when it detects any movement. The moment the gadget is turned on, it will notify the application by sending it a message. This project's objectives include developing an application for intruder detection utilizing an AVR microcontroller device, doing user acceptance testing, and implementing an external beta tester. The user can add as many hardware modules as they want to our device because it is modular. Owners of homes or businesses can use the software to get alerts in the case of any unlawful invasions. The gadget is implemented using the sensors

MC-38 (a magnetic switch) and SW-420 (a vibration sensor) to detect intrusions [8]. Using an FTDI programmer, the Arduino IDE code was transferred to the Mega 8A. A SIM 800L alert is transmitted to the application when the sensors are engaged. The app was created with Android Studio. The hardware gadget successfully alerts the application after detecting the intruder. Due of its adaptability, the gadget may be integrated into current security systems. The device's simplicity makes it ideal for expanding to meet user needs. The hardware of the gadget is constructed in a modular way, making it possible to simply improve it by integrating it with a wireless sensor network. An internet module can be added to the [20] to enhance the system. This would enhance the system's overall performance by enabling the computer to quickly switch between the two communication ports if one is unavailable. The Internet of Things (IoT) is a system of linked physical items that can communicate with one another and share information without the need for human intervention [5, 6]. IoT has been formally defined as an infrastructure of data Society because it enables the US to collect data from every type of medium, including individuals, animals, automobiles, and home appliances. Any physical object that is a scientific address and that can be made a part of the IoT framework by installing electronic hardware, such as sensors, software, and networking equipment within it will be. IoT differs from the Internet in that it allows common objects with embedded circuits to interact and communicate with one another via the Internet's already-existing infrastructure. The Federal Communications Commission (FCC) hearing Peter T. Lewis gave in 1985 is where the phrase "internet of things" first appeared. Since then, the Internet of Things has grown rapidly; there are currently over 12 billion connected devices in use, and researchers predict that figure will reach 50 billion by the end of 2020. By providing real-time data collecting and analysis via accurate sensors and seamless connection, the Internet of Things has assisted decision-making. The Internet of Things has helped both manufacturers and consumers. Manufacturers now have a better understanding of how their products are used and function in everyday life, which allows them to increase sales by providing value-added services that extend the lifespan of their goods or services [5, 6]. For a more customized and improved user experience, consumers can connect and keep an eye on many devices. Recent decades have seen a major advancement in home security, and this trend will continue in the years to come. An alarm that would sound if somebody broke in used to be the extent of home security systems, but a smart house is capable of much more. Therefore, the major goal of our research is to develop a tool that can alert the owner and other people in the event of an intruder break-in. Using the owner's mobile device, the alarm could also be remotely turned off or on. Installing the device on their homes will allow users to protect them. The number of devices linked to the Internet has increased significantly during the past few years. The IoT [5, 6] infrastructure, which includes all of these internet-connected gadgets, enables them to communicate with one another and exchange data. It is desirable to construct the suggested security framework using the current infrastructure because of this. An alarm that sounds like a buzzer is worthless when a user is not there in the house to act. Keep in touch with one another once the owner departs. They built up an IoT network with embedded electronics, sensors, and apps at their residence in order to have peace of mind knowing their home is secure from burglars and thieves while they are away. The proposed solution therefore keeps the owner informed of the state of their home's security in real time. When a break-in occurs, the built-in system alerts the user, allowing them to take the necessary action [3].

The Modern Security Alarm Sensors

Motion Detection Tomographic Sensor

Tomographic motion technology does not require a direct line-of-sight to activate a security warning, in contrast to the other security sensors we've discussed thus far. Tomographic motion detection, which is still proprietary and relatively new, uses a mesh network of radio emitters and receivers to find any movement within the mesh network. The way that this sensor technology detects motion is by looking for signal disruptions between emitters and receivers. Despite just being in use for around ten years, tomographic motion is a promising technique for high-security commercial and industrial sectors.

Microphones

While microphones use the audio spectrum to activate alarms, the majority of security sensors use the

electromagnetic spectrum. Don't undervalue microphone technology; these sensors are capable of considerably more nuanced detection than just audible sounds. For instance, the human ear is unable to detect some bands of ultrasonic frequencies released by broken glass. These inaudible frequencies can be found by microphone sensors, which can then send out alerts and alarms. Compared to electromagnetic-based sensors, microphones are less restricted to line-of-sight use and offer a very broad range of sensing capabilities. However, in order to support processing, the signals the microphones create, they are also more reliant on ancillary hardware and sophisticated software [4].

CONCLUSION

Numerous academic articles on security alarm systems have been evaluated for this study. The many types of sensors employed and their development for security system purposes are also covered.

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