# Automated Home Security System Based on Arduino

**Heiriz Iskandar Mohd Shamlan, Yufridin Wahab, Masri Zairi Mohd Zin**

***Abstract: Burglary means gaining an unauthorized access into others building or premises with intent to steal goods. It can be done by using shear force to break into the house, using false keys or other ways. A lot of burglaries have occurred by targeting single family houses. Normally, these breaks-in does not result in confrontations or injuries with the people who reside in the house as most breaks-in occur when the resident is out of the house. But in uncommon cases, some burglar will enter the premises when it is occupied and will threaten them with violence. Nowadays house burglary cases had risen in a wary ways. These problems can be solved in an effective method which is to use an automated home security system. Home security system becomes the most efficient solution to avoid the home intrusion issue which is happening quite often this day. As we know, most security house system is expensive and difficult to use. Therefore many people choose to neglect the implementation of a house security system in their house. For that particular reason, an effective and automated smart house security system at low cost with easy programming for user is built to overcome this issue. The project consists of several components namely the Arduino board as a microcontroller, the ESP8266 module as a Wi-Fi module, an Infra-Red (IR) sensor, vibration sensor and force sensor as a device to detect intrusion and the light emitting diode as a signal for any intrusion. In this project the sensors will detect for any kind of intrusion and then will alert the user via a smartphone application. In addition, all the data from the sensor will be stored in a cloud application called ThingSpeak. Consequently, users can monitor the house from everywhere via their mobile application.***

***Index Terms*: home automation, home security, Arduino**

## I. INTRODUCTION

Burglary means gaining an unauthorized access into others building or premises with intent to steal goods. It can be done by using shear force to break into the house, using false keys or other ways. A lot of burglaries have occurred by targeting single family houses. Normally, these breaks-in does not result in confrontations or injuries with the people who reside in the house as most breaks-in occur when the resident is out of the house. But in uncommon cases, some burglar will enter the premises when it is occupied and will threaten them with violence.

**Revised Manuscript Received on May 05, 2019.**

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Based on Malaysian federal police Crime Prevention and Community Safety Department, a total of 38,877 crimes involving properties were recorded in the first quarter of 2016 and a total of 6,662 cases involving house breaks-in. Fully gated residential area with 24-hours guards monitoring the area did help to prevent the breaks-in from happening. Netherless, it still didn't fully help to prevent and solve the breaks-in from occurring. This is because the security that implemented still has human-error that cannot be altered. So as the solution for this problem is to apply a fully automated home security system that can monitor and alert the residential for breaks-in.

Currently, home security system becomes the most efficient solution to avoid the home intrusion issue which is happening quite often this day. As we know, most security house system is expensive and difficult to use. Therefor many people choose to neglect the implementation of a house security system in their house. For that particular reason, an effective and automated home security system at low cost with easy programming for user is built to overcome this issue.

Automation is scientific and technological ways of manufacture of machine where its takeover most work that was done by humans. The manual security provided to property of individuals is cost more in term of money and labor. In addition of human errors also may affect the whole security system and a single mistake may fail the whole system. Hence automation in security purpose is necessary.

This project focuses on producing a smart home security system with an active infrared motion detector, pressure sensor and vibration sensor that can be controlled by using Arduino Uno. Then all the information that was identified by sensors, they would be informed to web server and then to mobile apps. Central web-server would get this information in real time by using Wi-Fi network, and user can know about the security of their house from anywhere whether they are at or not. Generally, this project can be divided into two main components. The first component focuses on hardware development. Second components focus on software programming for controlling for controlling the hardware. As the result of both main parts, the infrared detector, pressure sensor and light sensor are capable of detecting motion and in the same time the programmed Arduino Uno is capable to control the entire operation of the system.

This smart house security system is hoped to fulfil all the users' demand and make the home safer and comfortable. With this system, the security of the house can be increase and be more efficient. With the addition of mobile apps that can keep the user up to date information about their house's

security, user can be more calm and comfortable to leave their house for a period of time. Figure 1 shows an example of automated home security system.

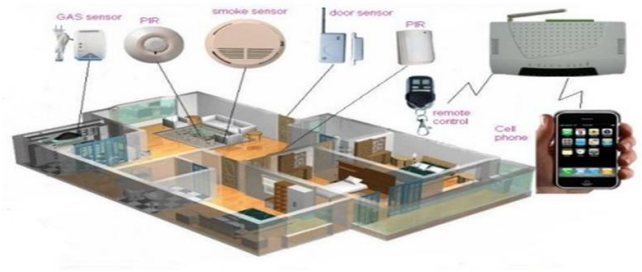



**Fig. 1 An example of automated home security system**

## II. SYSTEM DESIGN

The system consists of an Arduino Board, vibration sensor, IR sensor, forcepad sensor, LED, battery, microcontroller board (MCU) and mobile apps running in mobile phone. Figure 2 shows block diagram of automated home security system based on Arduino. Figure 3 shows the system components and image are copyright of owner/product manufactures/patent owners of the products (a) Arduino Uno board (Trademarks of Arduino AG) (b) Forcepad sensor (c) IR sensor (d) Vibration sensor. The sensor will check for any irregularities or sign of intrusion. Then, Arduino board will receive the data and collect the information to transmit to the cloud application called ThingSpeak via the wifi module. The cloud will collect the database automatically and send all the information through the smartphone application.

Arduino Uno based on ATmega328P is a microcontroller board. Figure 14 is the device of Arduino Uno board that been used in this project. It contains 14 digital input/output pins ( of which 6 can be used as PWM outputs) 6 analog inputs, a 16 MHz quartz crystal, a USB port, a power jack, an ICSP header and a reset button. It has everything needed to support the microcontroller, simply connect it to a computer with a USB cable or power it with an AC-to-DC adapter or battery to get started.

Infra-Red (IR) sensor works by using a specific light sensor to detect a select light wavelength in the infra-red spectrum. By using an LED which produces light at same wavelength as what the sensor using, thus the intensity of the received light can be detect. When an object is near to the sensor, the light from the LED reflect the object and enter into the light sensor. When there are large jump in the intensity, they can be detected by using a threshold. By using this principle, we can use the IR sensor to detect any kind of motion in order to prevent intrusion. A force sensor can measure force between almost any two surfaces and are strong enough to withstand any environment. Force sensor able to detect and measure rate of change in force, any kind of contact or touch and also the force threshold which will trigger appropriate action. In an electrical circuit, force sensor performs as a force sensing resistor. When there is no force, the resistance will be higher. The resistance will fall down when a force is applied to the sensor.

The SW-420 vibration sensor module has an adjustable potentiometer, a vibration sensor and a LM393 comparator chip to provide an adjustable digital signal output based on the amount of vibration. The sensitivity of the potentiometer that was embedded into the module can be adjusted to any desire amount. The output of the module is a logic level of low (GND) when isn't triggered and logic level high (VCC) when triggered. An addition of onboard LED is put onto the module to indicate when the module is triggered. This sensor module will take an external force applied on it as its input and produce logic states depend on the vibration as the output. When the sensor feels any vibration applied on it, the output will become logic HIGH (1). As the sensor didn't sense any vibration, it will remain under logic LOW (0) output. When there is a movement or vibration, the rollers of the conduction current in the switch will create a movement which will cause the current passing through to disconnect or rise of resistance and trigger the circuit. By using its features, the module can be used for detecting any kind of breaks-in by placing it on strategic places.

The other main component of the system is the Light Emitting Diode or LED. Its function is to produce sufficient light for detection of intrusion. LEDs make great indicator lights.

The ESP8266 NodeMCU board or module can give any microcontroller access to Wifi network.

Battery as the power supply to the whole systems provides all the required system power. This can be further strengthened with the household electrical utility supply.

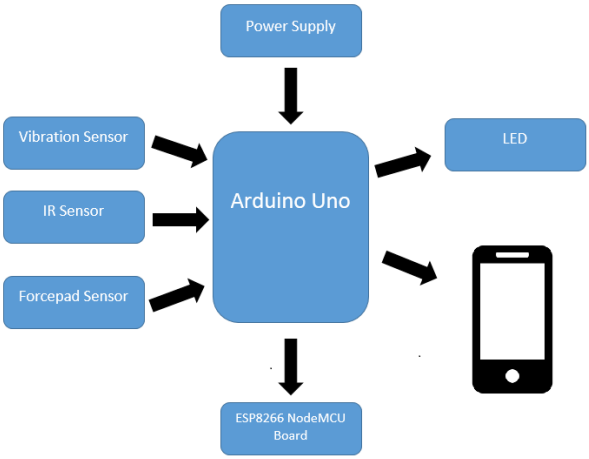
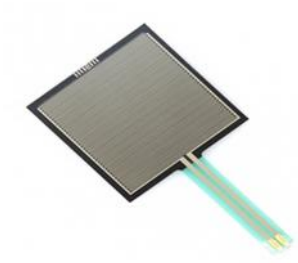
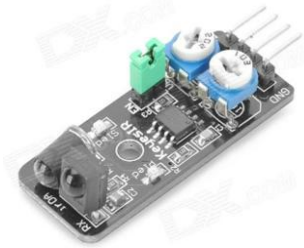



**Fig. 2 Block Diagram of Automated home security system based on Arduino**

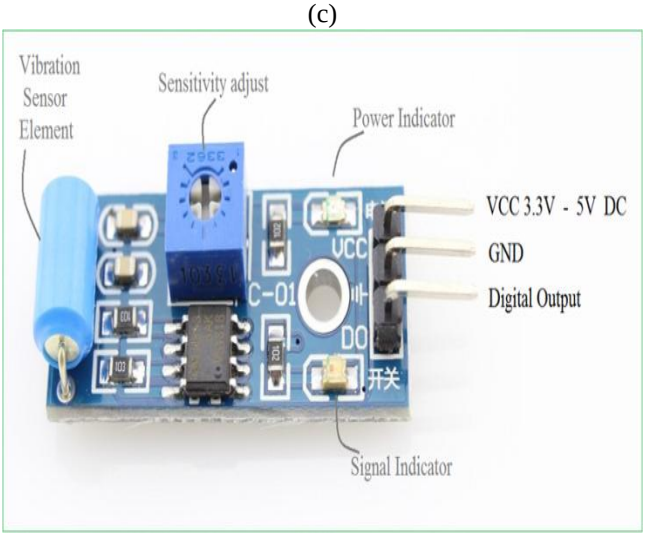
(a)



(b)



(c)




(d)

**Fig. 3 The system components and image are copyright of owner/product manufactures / patent owners of the products (a) Arduino Uno board (Trademarks of Arduino AG) (b) Forcepad sensor (c) IR sensor (d) Vibration sensor**

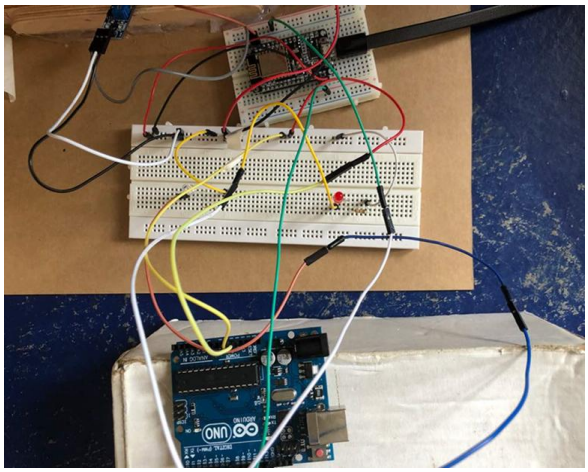


**Fig. 4 The hardware integration**

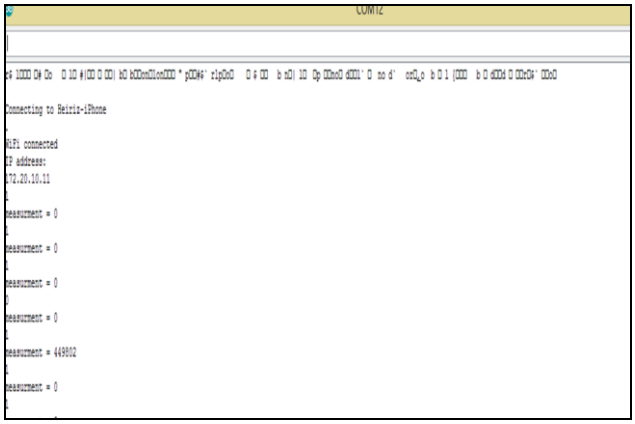



**Fig. 5 The sensor activation and system response to the activation showing the sensors were triggered and the system captured the trigger**

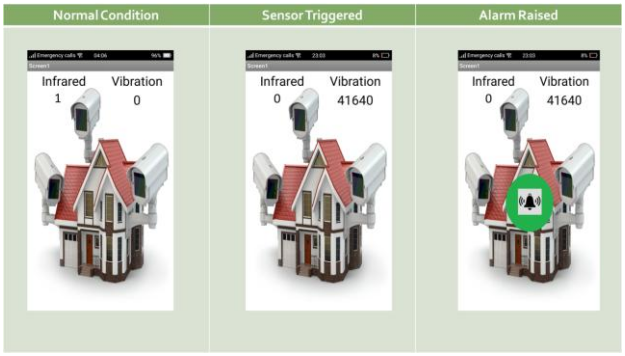



**Fig. 6 Mobile application show the data receive from ThingSpeak and alert the user**

**Fig. 7 An example of mobile application**


**Fig. 8 An example of smartphone application layout**

## III. HARDWARE INTEGRATION RESULT

This research was successfully conducted up to the complete hardware development and implementation. Figure 4 shows the integration of hardware on the breadboard. The system hardware is running according to the intended design. Figure 5 shows the result of sensor trigger and the corresponding system capture proving the functioning of the system and sensors altogether. Figure 6 shows the data receive from ThingSpeak and alert the user by using Mobile application. Figure 7 shows an example of mobile application. Figure 8 shows an example of smartphone application layout.

## IV. CONCLUSION

This research was successfully conducted up to the complete hardware development and implementation. The system interconnection and intercomponent communication works according to the design. The system responded according to the trigger successfully.

## ACKNOWLEDGMENT

Finally, the authors like to acknowledge their appreciation to the anonymous reviewers who gave freely time and effort, constructive recommendation to enchance the value of this manuscript. The authors also want to express their deepest thanks and appreciation to the Northern Corridor Implementation Agency Malaysia, University Malaysia Perlis and the Ministry of Education for supporting these studies.

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## AUTHORS PROFILE

**Heiriz Iskandar Mohd Shamlan** was born in Perak, Malaysia, in 1995. He has a Bachelor of Engineering (Hons) (Electronic Engineering) from Universiti Malaysia Perlis (UniMAP) in 2018. His current interests are on electric and electronic fields.

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**Yufridin Wahab** was born in Kedah, Malaysia, in 1972. Assoc. Prof. Dr. Yufridin Wahab received his Bachelor of Engineering in Electrical and Electronic Engineering (honours) from Universiti Sains Malaysia (USM) in 1996, with specialization in Microelectronic Engineering. In 1999, he completed his M.Sc. in Electrical and Electronic Engineering in the same university. During his study, he successfully design, fabricated and characterized an integrated circuit using the USA based MOSIS MPW service. He completed his Doctorate in Electrical Engineering degree studies in 2009 during which he successfully design, fabricated and characterized another integrated circuit with MEMS Pressure Sensor using Infineon Technologies MPW process in Europe. In 1999, he started his industry experience in LSI Logic Corp. in Gresham, Oregon, USA for a one year technology transfer program. Upon completion of one year tenure in USA, he started his job as one of the pioneering engineering group in the Malaysia's first silicon wafer foundry, namely Wafer Technology Sdn Bhd (which later changed name to Silterra Malaysia Sdn Bhd). In 2002, he joined the pioneering group of the first five lecturers from USM to set-up a new university in Perlis named Kolej Universiti Kejuruteraan Utara Malaysia (KUKUM) which later was flourished to become Universiti Malaysia Perlis (UniMAP). In 2011, he was awarded a special grant by NCIA and Silterra to develop and set-up the first of its kind industry standard MEMS fabrication laboratory in UniMAP named Advanced MEMS Based Integrated Electronics NCIA Centre of Excellence (AMBIENCE). He is also currently in charge of the setting up and operations of UniMAP industry centred Research Training and Continuing Education Centre (UniMAP RETRACE) in Kulim Hi-Tech Park where many engineers in Kulim high-technology industries and Penang enrolled for Masters and PhD degree programmes in microelectronic design and manufacturing fields. He was also awarded and successfully completed many long term semiconductor/electronics industry human capital development projects for the multinationals such as the 11 years long Agilent-UniMAP-Development Programme, 1 year long Silterra-NCIA-UniMAP programme, Hewlett-Packard 6 months FETMEMS program and many others. He had trained a total of more than 1000 fresh graduate microelectronic engineers and also 1000 working industry engineers for the semiconductor industry. He had more than 90 publications in the field on semiconductor device, IC design, MEMS design and fabrication in journals, books and international conferences. He also collected many internationally recognized innovation awards and patents in electronics and semiconductor fields.

**Masri Zairi Mohd Zin** was born in Perlis, Malaysia, in 1986. He received the Diploma in Mechanical Engineering and Bachelor of Engineering (Hons) Mechanical from the Mara University of Technology (UiTM), Malaysia in 2007 and 2010, respectively. In 2010, he joined Fuji Electric (Malaysia) Sdn. Bhd, as a R&D Engineer, and then in 2013 he joined Infineon Technologies (Malaysia) Sdn. Bhd as a Maintenance Engineer. Since 2014, he works with AMBIENCE Centre Of Excellence, Universiti Malaysia Perlis (UniMAP), where he is a Teaching Engineer. His current interests include MEMS & wafer fabrication. Masri Zairi is a registered trainer (Certificate No: TTT/11993) for Human Resources Development Fund (HRDF) where HRDF is an agency under the purview of the Ministry of Human Resources Malaysia.