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IOT Based Arduino MiNi-Project

(The project is based on Arduino, PIR motion detection sensor and GSM Module.)

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Section:- K18PG

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Ashwani Kumar,

Sk Md Shoyal,

E Damodar Goud

DECLARATION

We hereby declare that we carried out the work reported in this project in the Department of Computer Science and Engineering, Lovely Professional University, under the supervision of Pawandeep Kaur. We solemnly declare that to the best of our knowledge, no part of this report has been submitted elsewhere for award of a degree. All sources of knowledge used have been duly acknowledged.

Letter of Acceptance

We hereby declare that the major project entitled “Home Security System” being submitted by Pawandeep Kaur and Faculty of Computer Science and Engineering Department, Lovely Professional University, Punjab in partial fulfillment for the award of the degree of Bachelor of Science in Computer Science and Engineering, is a record of major project carried out by them. They have worked under my supervision and guidance and have fulfilled the requirements which to my knowledge have reached the requisite standard for submission of this dissertation.

ABSTRACT:-

Now a days we are upgrading our life day by day using modern technologies. But where the topic “technology” arises, we have to talk about a lot of electronic devices that we have got by the blessings of science. We are using these technologies for several purposes. This project is also an implementation of modern technology. We have designed and developed an arduino based smart security system, using alarm and SMS based security. The Arduino Based security is the initial and GSM is the secondary security we have implemented. GSM will confirm you by sending a SMS that, security is interrupted. Here we have used a photo sensor to detect the laser light and used 5V relay to turn on the camera to capture the interrupter and used SIM 808 GSM device for SMS confirmation. Here by reflecting the laser light with mirror, a particular space has been secured by laser, A program has been developed and burnt into the microcontroller of the Arduino module. This system is constructed and tested and found to work satisfactory. The developed system can be used for any security purposes. Example: Bank Vault Security (to secure the bank vault room), Museum (where a lot of ancient and precious things are preserved), Offices (where unauthorized entry is prohibited) and so on. Finally our security system can be more upgradable with some modification.

CRITICAL APPRAISAL OF WORK DONE:-

Today, with advancement in science and technology, home automation has become one of the fastest developing application-based technologies in the world. The idea of comfortable living in home has since changed for the past decade as digital, vision and wireless technologies are integrated into it. Intelligent homes, in simple terms, can be described as homes that are fully automated in terms of carrying out a predetermined task, providing feedback to the users, and responding accordingly to situations. In other words, it simply allows many aspects of the home system such as temperature and lighting control, network and communications, entertainment system, emergency response and security monitoring systems to be automated and controlled, both near and at a distance.

Automated security systems play an important role of providing an extra layer of security through user authentication to prevent break-ins at entry points and also to track illegal intrusions or unsolicited activities within the vicinity of the home (indoors and outdoors). There has been much research done in the design of various types of automated security systems. Sensor-based systems that rely on contact or movement sensors or contact-based systems such as fingerprint and palm print scan or keypad activation that require substantial amount of contact with an input device.

Many security systems are based on only a single system. In an event of system failure or intrusion of the user authentication, there is no backup system to monitor the home continually. This shortcoming can be dealt with using multiple security systems (or multi-layered security systems). However, multi-system implementations will definitely be more demanding in terms of computational cost and organization.

Theoretical Survey:-

New opportunities from new technology are the biggest reasons why many people feel the need of greater security. Redesigning different processes and products to support the modern technology smart security system is established.

In the literature, there are few contributions proposed in recent years in machine-to-machine, mobile-to-machine, or machine-to-mobile communication. These include: laser security protection and GSM Network protection. The basic sensor component of a modern laser security system is an infrared motion detector. An infrared motion detector works by using beams of infrared light to detect changes in heat. When a person moves into the beam of light, the sensor is alerted by the body heat given off by the individual. If infrared sensors are placed well, the beams of light will make it impossible for an intruder to come into the area without the sensor being alerted. The sensor which is connected to the basic alarm unit through a wireless connection, then triggers the basic unit to alert the monitoring service through which the customer purchased the security plan. The monitoring service will contact the home and, if no response is received, will contact the police. In most models, the basic unit also sounds a loud alarm. PIR Sensor systems have become extremely popular over the last few decades as the technology has improved and become more affordable. Here PIR uses to transmit video and sometimes audio images to a monitor. The main advantage of GSM alarm over the general fixed phone alarm is that the owner can always obtain information about the current state of the place protected, even when he is in another city or country, by calling or sending SMS query to the number of SIM card.

Introduction:-

In this modern world, Analog Electronics devices are becoming less popular and digital electronics components are becoming more advanced and popular day by day. Smart security system is also an example of modernized digital world. The basic concepts of this project is to ensure the security system of homes, bank vaults, offices. Laser and GSM modules are used to give the highest security system. People are using cellular mobile phone network to communicate each other. GSM modules are basic elements of these phone networks. GSM stand for global system of mobile communication. It is also used in many electronics projects among engineering students and also very popular in industry. Such complex systems may be expensive and may not be affordable by everyone. There are individual security systems based on the requirement. Home Security Systems are an important feature of modern residential and office setups. Home security systems must be affordable, reliable and effective.

In this project, we designed a simple but very efficient home security that has a function of calling the homeowner on his/her mobile number in case of an intruder alert. Nowadays we use the different type of GSM based home security system in our home to protect from Intruder and thief. There are the different PIR home security system in the market depending on their applications. This Arduino PIR sensor project based security system is one of them. This motion sensor based security system detects any trespassing that occurs in the range of the motion sensor. Depending on the movement of the object it sends a signal to the Arduino board. This GSM home security alarm system with Arduino has the capability of sending SMS alert once any PIR motion sensor detects the movement. This SMS sending gives the user a great safety feature remotely. It also has one Arduino burglar alarm in the system. Modern complex home security systems include several security features like fire, intruders, electronic door lock, heat, smoke, temperature, etc. Some security systems may be a combination of all the security measures. Working with PIR motion sensor and Arduino is very easy. When it detects some movement, it sends a digital output to Arduino and Arduino take decisions accordingly like turn ON/OFF the alarm, lights or sending SMS alert message to the owner of the home.

OBJECTIVE:-

The objective of this project is to develop a modern security system, in which the Arduino Based Security System stimulates the PIR in the case of entry intruders during the absence of the owner. The security is used for sensing and GSM messaging to the owner in any insecure condition. Security is a most important factor today. Technology develops day by day in the world. The crime gang also improves their technology to perform their operation. So technology of security should be modern with time to protect the crime works. We decide to make a security project as our project. In this project we have used laser light to cover a large area. We know PIR light rays go through 7m distance and 120 Degree rotation without scattering effect.. These two properties help us to build up a modern security system, which may name as “Arduino Based Security”. When any intruder enters, the PIR Sensor will sense and activate GSM to send SMS to the owner. We can make a security boundary of few PIR. Our project provides complete information on the topic "Arduino Based Security System" and maximum efforts have been taken to make the project more comprehensive and lucid to understand. Our project covers a variety of sub topics like its working, setup, uses in life and different aspects of Arduino Security Alarm System.

GSM MODULE:-

SIM900A module: SIM900A module is a GSM and GPS two-in-one function module. It is based on the latest GSM/GPS module SIM900 from SIMCOM, supports GSM/GPRS Quad-Band network and combines GPS technology for satellite navigation. It features ultra-low power consumption in sleep mode and integrated with charging circuit for Li-Ion batteries, that make it get a super

-25 -| P a g e long standby time and convenient for projects that use rechargeable Li-Ion battery. It has high GPS receive sensitivity with 22 tracking and 66 acquisition receiver channels. Besides, it also supports A-GPS that available for indoor localization. The module is controlled by AT command via UART and supports 3.3V and 5V logical level. Figure 5:SIM808 Module.

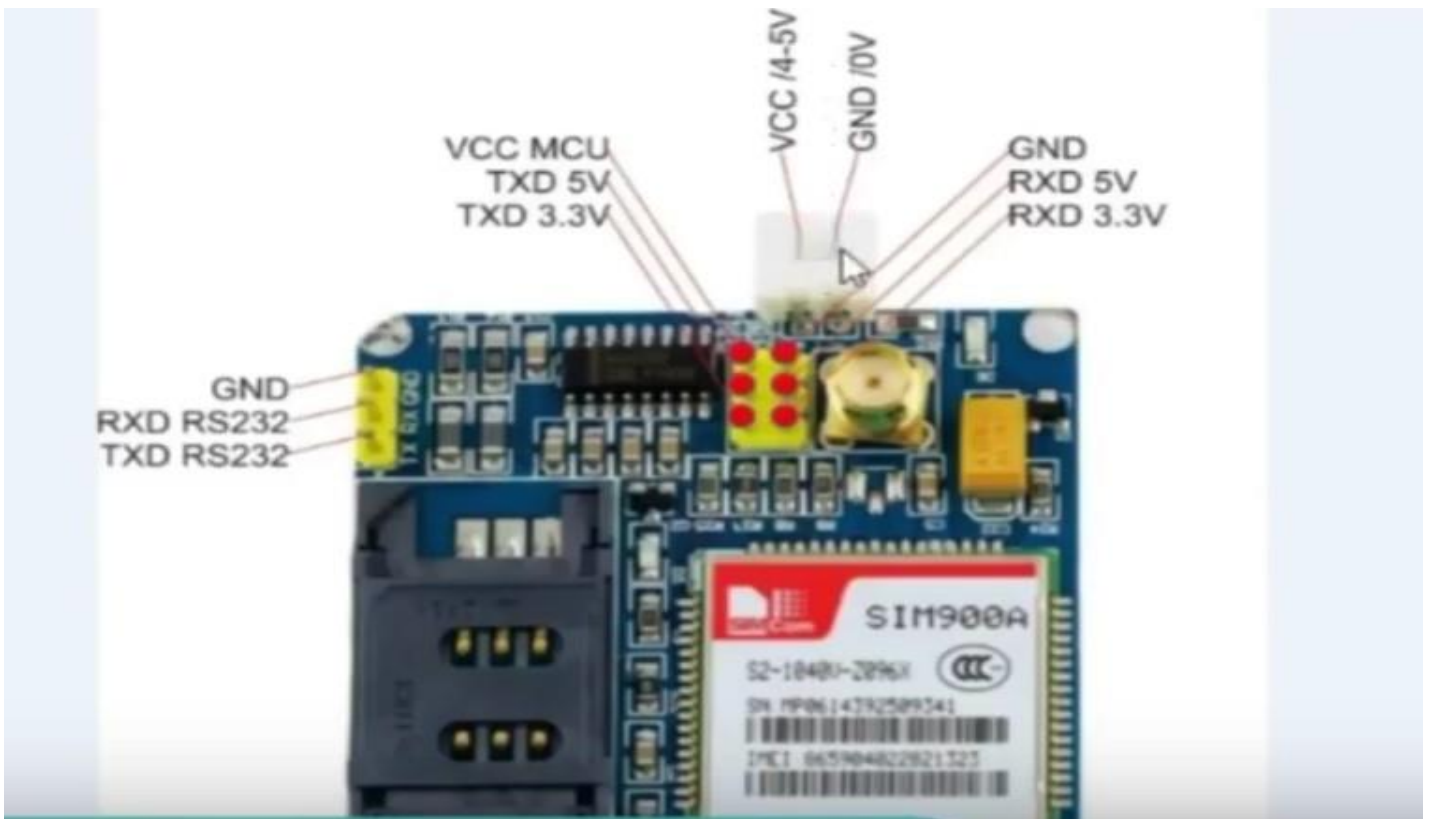
SIM 900A is the GSM/GPRS module with built in RS232 interface. It has dual band GSM/GPRS system that works on 900/1800MHz frequencies. With the help of RS232, the modem can be connected to PC or microcontroller via serial cable. Voice calls, SMS and internet access are possible with this module. There are on board connections for microphone and headphones with which we can make or receive calls.

The main features are given below:

- 1. Quad-band 850/900/1800/1900MHz**
- 2. GPRS multi-slot class12 connectivity: max. 85.6kbps(down-load/up-load)**
- 3. GPRS mobile station class B**
- 4. Controlled by AT Command**
- 5. Supports charging control for Li-Ion battery**
- 6. Supports Real Time Clock**
- 7. Supply voltage range 3.4V ~ 4.4V**
- 8. Integrated GPS/CNSS and supports A-GPS**
- 9. Supports 3.0V to 5.0V logic level**
- 10. Low power consumption, 1mA in sleep mode**
- 11. Supports GPS NMEA protocol**

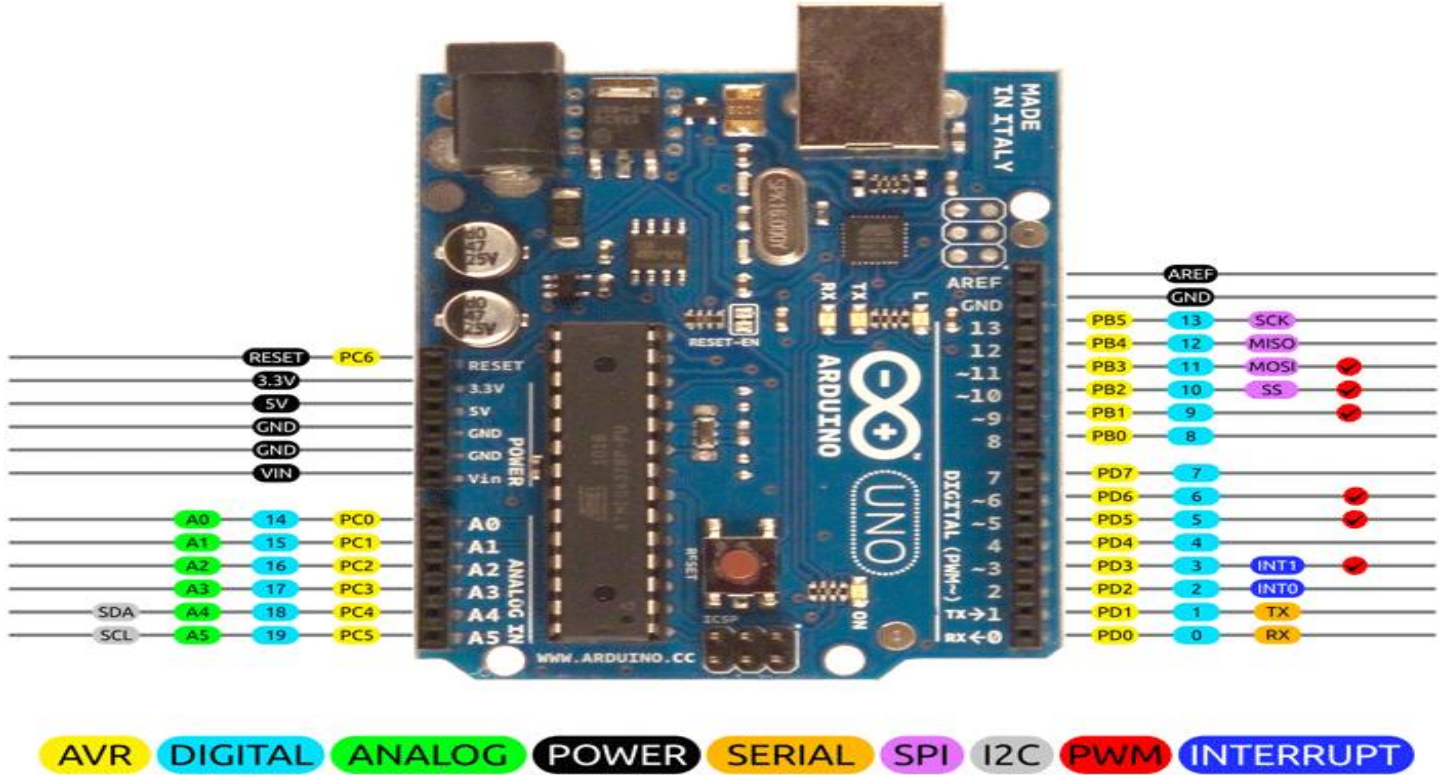
12. Standard SIM Card

Designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS1900 MHz. SIM300 provides GPRS multi-slot class 10/ class 8 (optional) capability and support the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. With a tiny configuration of 40mm x 33mm x 2.85 mm, SIM300 can fit almost all the space requirement in your application, such as Smart phone, PDA phone and other mobile device. The physical interface to the mobile application is made through a 60 pins board-to-board connector, which provides all hardware interfaces between the module and customer boards except the RF antenna interface.



ARDUINO

It is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software. It's intended for artists, designers, hobbyists, and anyone i



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Interested in creating interactive objects or environments. Arduino can sense the environment by receiving input from a variety of sensors and can affect its surroundings by controlling lights, motors, and other actuators. It is the main controller used in this project. It detects the signals from PIR sensor and sends commands to GSM Module accordingly. The serial pins of the Arduino are used in this project to communicate with GSM module.

Software Design:- First we write the Arduino program in Arduino so"" Then we compile it to the Arduino hardware. This Arduino AT command is control the hardware and other circuit connection. Installing Arduino, runs on Windows. Go to the Arduino software website at [Arduino /Main/Software](http://arduino.cc/Main/Software) and download the version of the software compatibility. We use Arduino Latest version. Our System should Verifying the Hardware. Now that we have the Arduino IDE software installed, load a small program, and verify that all components are working together. First, need to connect the USB cable to our Laptop Port and then plug the other end of the USB cable into our computer.

Arduino Security System Code – Sending SMS:- As we have used the interrupt to read the motion sensor input. When Arduino receives the signal from the motion sensor. It stops executing the normal code and control goes to the ISR(Interrupt Service Routine). ISR is the location of the code. And after the interrupt, control come here and execute the code available at this location. The different interrupt has its own ISR. Here the function void make SMS is executed when some movement is detected by the PIR sensor. In this section, arduino sending the SMS to the owner of the home and activated the alarm.

Hardware Required:-

- **Arduino UNO**
- **PIR Motion Detection Sensor**
- **SIM 900A (or any other) GSM Module with SIM inserted**

Circuit Design of Arduino GSM Home Security Alarm System:- As the project is based on an Arduino, the connection is pretty simple. PIR motion detection sensor module has a digital output pin. This is connected to any of the digital I/O pins of the Arduino. The GSM Module communicates with the microcontroller in a serial manner. It has an Rx and Tx pins on the board. These pins are connected to the Tx and Rx pins of the Arduino. It is important to note that while uploading the program (sketch) to Arduino, the GSM module must be disconnected as it might interfere with the serial communication with the Arduino IDE. Microcontroller on the board is programmed using the Arduino programming language and the Arduino development environment. Arduino projects can be stand-alone or they can communicate with software running on a computer (e.g. Flash, Processing,).The Arduino Uno is a microcontroller board based on the ATmega328 (datasheet). It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header, and a reset button. It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power it with a AC-to-DC adapter or battery to get started.

Arduino Language:- The Arduino language is implemented in C/C++ and based in Wiring. When we write an Arduino sketch, we are implicitly making use of the Wiring library, which is included with the Arduino IDE. This allows us to make run able programs by using only two functions setup () and loop (). As mentioned, the Wiring language is inspired by Processing, and the Arduino language structure is inherited from the Processing language, where the equivalent functions are called setup (). We need to include both functions in every Arduino program even if we don't need one of them. Let's analyze the structure of a simple Arduino sketch using again the Blink example. Logical Diagram We have a logical diagram for this project. Here android mobile phone works as a input signal which start from beginning part. We have got output from electronic devices.

Pin Description:-

Arduino Pins and Jacks: Power -USB / Barrel Jack: Arduino board needs a way to be connected to a power source. The Arduino UNO can be powered from a USB cable coming from your computer or a wall power supply that is terminated in a barrel jack. In the picture above the USB connection is labeled and the barrel jack is labeled. The USB connection is also how you will load code onto your Arduino board.

Pins (5V, 3.3V, GND, Analog, Digital, PWM, AREF): The pins of Arduino are the places where connect wires to construct a circuit. The Arduino has several different kinds of pins, each of which is labeled on the board and used for different functions.

- **5V:** The 5V pin supplies 5 volts of power. Most of the simple components used with the Arduino run happily off of 5 or 3.3 volts.
 - **GND:** Full name is Ground. There are several GND pins on the Arduino, any of which can be used to ground circuit.
 - **Analog:** The area of pins under the 'Analog In' label (A0 through A5 on the UNO) is Analog In pins. These pins can read the signal from an analog sensor and convert it into a digital value that we can read.
 - **Digital:** Across from the analog pins are the digital pins (0 through 13 on the UNO). These pins can be used for both digital input and digital output (like powering an LED).
 - **PWM:** The digital pins (3, 5, 6, 9, 10, and 11) on the UNO are the PWM (—) pins. These pins act as normal digital pins, but can also be used for something called Pulse-Width Modulation (PWM).
 - **AREF:** Stands for Analog Reference. It is sometimes used to set an external reference voltage (between 0 and 5 Volts) as the upper limit for the analog input pins.
 - **Power LED Indicator:-** Just beneath and to the right of the word "UNO" on circuit board, there's a tiny LED next to the word 'ON'. This LED should light up whenever plug Arduino into a power source. If this light doesn't turn on, there's a good chance something is wrong.
 - **Reset Button:-** The Arduino has a reset button. Pushing it will temporarily connect the reset in to ground and restart any code that is loaded on the Arduino. This can be very useful if code doesn't repeat, but we want to test it multiple times. Unlike the original Nintendo however, blowing on the Arduino doesn't usually fix any problems.
 - **TX RX LEDs** TX is short for transmit, RX is short for receive. In our case, there are two places on the Arduino UNO where TX and RX appear once by digital pins 0 and 1, and a second time next to the TX and RX indicator LEDs. These LEDs will give us some nice visual indications whenever Arduino is receiving or transmitting data.
- Main IC** The black thing with all the metal legs is an IC, or Integrated Circuit. The main IC on the Arduino is slightly different from board type to board type, but is usually from the AT mega line of IC's from the ATMEL Company. This can be important, as may need to know the IC type before loading up a new program from the Arduino software. This information can usually be found in writing on the top side of the IC.
- Voltage Regulator:** The voltage regulator is not actually something

interacting with on the Arduino. But it is potentially useful to know that it is there and what it's for. It controls the amount of voltage that is let into the Arduino board. It will turn away an extra voltage that might harm the circuit.

- **Getting started with Arduino Software:-** First download and install the Arduino for Mac, Linux or Windows from arduino.cc. Windows users also need to install a driver. Connect your board via USB, launch the Arduino application and select Arduino-Uno from the tools to board menu. Open the sketch File. Open Examples: 01. Basics: Blink. Click the toolbar button to upload it to your board.

The Integrated Development Environment (IDE):- Every microcontroller needs software to be programmed. The Arduino board is not a case apart. It has its own integrated development environment (IDE), It is free and everyone can download from its official website using either the Windows, Mac OS X or Linux platform. That allows Arduino Board to gain more users and it also helps it to grow.

IDE Parts:-

Compile: Before program "code" can be sent to the board, it needs to be converted into instructions that the board understands. This process is called Compiling.

- **Stop:** This stops the compilation process.
- **Create new Sketch:** This opens a new window to create news ketch.
- **Open Existing Sketch:** This loads a sketch from a file on our computer.
- **Save Sketch:** This saves the changes to the sketch.
- **Upload to Board:** This compiles and then transmits over the USB cable to our board.
- **Serial Monitor:** Until this point when our programs (sketches) didn't work, we just pulled out our hair and tried harder.
- **Tab Button:** This lets you create multiple files in your sketch. This is for more advanced programming than we will do in this class.
- **Sketch Editor:** This is where write or edit sketches
- **Text Console:** This shows you what the IDE is currently doing and is also where error messages display if make a mistake in typing program.

How to Build Motion Sensor SMS Alert System?

For this project you should know:-

- ❖ **How to interface PIR sensor with arduino, and**
- ❖ **How to interface gsm modem with arduino.**

At the end connect all the modules.

PIR Motion Detection Sensor:-

Passive Infra-Red or PIR Sensor is a Pyroelectric device that detects motion. Hence, it is also called as motion detection sensor. It detects motion by sensing the changes in infrared levels emitted by nearby objects.



Hardware Required:-

Arduino Uno

- PIR Motion Sensor
- GSM Modem
- Pinout and Rating of PIR

Pin Name Function :-

– **GND** Connects to Ground or Vss.

+ **Vcc** Connects to Vdd (3.3V to 5V) @ ~100uA.

OUT Output Connects to an I/O pin set to INPUT mode.

Jumper Setting in PIR:-

Position	Mode	Description
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H	Retrigger	Output remains HIGH when the sensor is retriggered repeatedly. The output is LOW when idle (not triggered).
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Position Mode		Description
L	Normal	Output goes HIGH then LOW when triggered. Continuous motion results in repeated HIGH/LOW pulses. The output is LOW when idle.



PIR Sensor Calibration:- PIR sensor needs some “warm-up” time to function correctly. Because there is some settling time involved in learning its environmental conditions. This time is approx 10-60 seconds. During this time there should be a slow motion in sensors field of view.

PIR Sensor Sensitivity:- PIR sensor has a range approx 20feet and depends on environmental conditions. It is designed to adjust in slowly changing conditions this generally happens when day progresses. It responds by giving a high signal on the sudden change in its environment.

Product parameters:

- 1) detection angle of 120 degrees.
- (2) detection range of 7 m.
- (3) Size: 32x24mm
4. TTL switch signal output high signal output (3.3V), low signal output (0.4V).
- 5 trigger time is adjustable 0.3 seconds to 10 mins
6. Commonly used in anti-theft devices and other equipment.
- 7 modules have been forced to set to work reusable trigger

PIR Motion Sensor GSM Modem Connection with Arduino:-

In the previous tutorial, we have interfaced PIR motion sensor with the arduino. And the interfacing and programming are quite easy to understand. The good feature of this project is to send SMS with GSM Modem when the PIR sensor detects any movement. The interrupt in this project makes it very reliable in detection of PIR Sensor. PIR motion sensor is connected with arduino digital pin 2 using the interrupt feature. The main feature of this arduino burglar alarm project is to send the SMS to the mobile phone of an owner when it detects any trespassing or movement in the PIR sensor area. For sending the SMS we have used the SIM900A. You can use the SIM900 or equivalent. The important thing is, we should know how to interface GSM module with arduino and send the SMS. The second important part is using interrupt we are reading the motion sensor value. So the question is why to use the interrupt.

The working of the project is explained below:-

PIR sensor detects motion by sensing the difference in infrared or radiant heat levels emitted by surrounding objects. The output of the PIR sensor goes high when it detects any motion. The range of a typical PIR sensor is around 6 meters or about 30 feet. For proper operation of PIR sensor, it requires a warm up time of 20 to 60 seconds. This is required because, the PIR sensor has a settling time during which it calibrates its sensor according to the environment and stabilizes the infrared detector. During this time, there should be very little to no motion in front of the sensor. If the sensor is not given enough calibrating

time, the output of the PIR sensor may not be reliable. When the PIR sensor detects any motion, the output of the sensor is high. This is detected by the Arduino. Arduino then communicates with the GSM module via serial communication to make a call to the preprogrammed mobile number. An important point to be noted about PIR sensors is that the output will be high when it detects motion. The output of the sensor goes low from time to time, even when there is motion which may mislead the microcontroller into considering that there is no motion. This issue must be dealt with in the programming of Arduino by ignoring the low output signals that have a shorter duration than a predefined time. This is done by assuming that the motion in front of PIR sensor is present continuously.

Circuit Design of Arduino GSM Home Security Alarm System:-

As the project is based on an Arduino, the connection is pretty simple. PIR motion detection sensor module has a digital output pin. This is connected to any of the digital I/O pins of the Arduino. The GSM Module communicates with the microcontroller in a serial manner. It has an Rx and Tx pins on the board. These pins are connected to the Tx and Rx pins of the Arduino. It is important to note that while uploading the program (sketch) to Arduino, the GSM module must be disconnected as it might interfere with the serial communication with the Arduino IDE.

Working of Arduino GSM Home Security Alarm System:-

Home Security Alarm Systems are very important in present day society, where crime is increasing. With the technological advancements we have achieved in the recent years, a homeowner doesn't have to worry about home security while getting off his/her home. Modern home security systems provide enough security from burglars, fire, smoke, etc. They also provide immediate notification to the home owner. The aim of this project is to implement a simple and affordable, but efficient home security alarm system. The project is designed for detecting intruders and informing the owner by making a phone call.

Discussion:-

The security system is capable of controlling of the appliances from any place where GSM service is available. The combination of the hardware and software give the final design. There were some problems encountered in our project development which can be stated as under:-

- ❖ Most home security systems are made of a basic alarm unit with Arduino and GSM Module.**
- ❖ With the development of operating system this type of security could be hampered.**
- ❖ Unavailability of components in the local market.**
- ❖ We have facing many problems for using GSM SIM808**
- ❖ Coding issues also creates some problems.**

Code:-

Software and development:-

Full Circuit Diagram:-

Here we have connected the GSM module with ARDUINO UNO. Here TX of arduino is connected with GSM RX and RX of arduino is connected with TX of GSM module. Respectively VCC and GND also connected from Arduino module.



Future Work Scope:-

We can upgrade our project by using Metal PIR sensors for safe entry and unsafe entry, finger print sensor for controlling Arduino Based security system a lots of modification we can do to upgrade this. This project has a lot of upgradable scopes. The future implications of the project are very great considering the amount of time and resources it saves. The project we have undertaken can be used as a reference or as a base for realizing a scheme to be implemented in other projects of greater level such as weather forecasting, temperature updates, device synchronization, etc. The project itself can be modified to achieve a complete Home security System which will then create a platform for the user to interface between himself and his household.

Conclusion:-

The focus of this project is to develop a security system using the concept of Arduino Based-security System and SMS security with GSM module. An electronic circuit is designed so that when anyone interrupt the PIR Sensor. An Arduino with interface that can be plugged into GSM modem. The project is successfully developed and met the stated objectives. In addition, The system is very practical when the user is away from the place; through it the user get message with the electrical device remotely as long as the mobile phone gets the coverage. The Smart Security systems have many advantages. They are simple to install and can be used successfully inside or outside a home. The sensors can be hidden on the Outer Surface of Home and specially the Boundary areas. The project we have undertaken has helped us gain a better perspective on various aspects related to our course of study as well as practical knowledge of electronic equipment and communication. We became familiar with software analysis, designing, implementation, testing and maintenance concerned with our project. The extensive capabilities of this system are what make it so interesting. From the convenience of a simple Arduino Based Security System, a user is able to get alert through PIR Sensor by SMS of GSM Module. This makes it possible for users to rest assured that their belongings are secure. The end product will have a simplistic design making it easy for users to interact with. This will be essential because Advance technical knowledge to the homeowner's security.

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