Arduino based Security System – An Application of IOT

Girish Yadav B.Tech(CSE) IV Year, CVR College of Engineering, Hyderabad M.Sathya Devi, Assistant Professor, Dept of CSE, CVR College of Engineering, Hyderabad

ABSTRACT :

Internet Of Things (IOT) is an upcoming technology that makes use of Internet to control/monitor physical devices connected to the Internet. The basic premise is to have smart sensors collaborate directly without human involvement to deliver a new class of applications. IOT gives user the ability to control more than one digital thing easily through a comfortable GUI over the Internet. By this paper an effort has been made to concentrate on researching in the field of IOT and making the use of the latest tools in the field of IOT to provide better user experience to the naive users of IOT. This research paper is based on the concepts of IOT, where in an unauthorised or unwanted intrusion or motion is detected using different hardware and software tools. This paper makes the use of an Arduino Uno board, which forms the basis of this IOT research. To the Arduino, an ultrasonic sensor that detects the movement of a person is used in unison with a Piezo buzzer. An effort is being made to use a GSM module with the Arduino. This will be used to send and receive messages. A message would be sent to the authorised number whenever an unwanted movement is detected by the sensor. On detection of an unauthorised movement, first the buzzer starts sounds alarm at a particular tone and then the message is sent to the user/owner. In addition to this, an effort would be made to use a Wi-Fi module also. This Wi-Fi module is used to connect to the Internet in order to send and receive the data. The received data is projected onto a cloud based server dashboard to detect flow of intruder in the system. Lastly, a cloud storage system called pCloud.com is used to store the information, documentation and research related to this project.

Keywords: IOT (Internet Of Things), ultrasonic sensor , Piezo buzzer , GSM module , Wi-Fi Module ,cloud server, pCloud.com .

INTRODUCTION TO IOT:

[16] IOT was initially invented by Kevin Ashton in early 2000's. It was developed by linking RFID information to Internet, which was used for business purpose. This was supported by Proctor and Gamble company for their business. The concept was simple but powerful. If all objects in daily life were equipped with identifiers and wireless connectivity, these objects could communicate with each other and be managed by computers.

IOT describes about connecting the physical devices with the sensors to the Internet, via wired or wireless networks. These sensors can use various types of local area connections like RFID, NFC, Wi-Fi, Bluetooth, and Zigbee. Sensors can also have wide area connectivity such as GSM, GPRS, 3G, and LTE.

The three C's of IOT

Communication:

The main intension of IOT is to provide a communication among the physical devices, systems and people. Each and every domain needs the exchange of information in one way or the other. For example, the medical domain the information about the patients, in some cases the critical information has to be sent, so that a immediate action could be taken. The critical information in the form of either blood pressure or the pulse rate could be measured with the help of sensors. In case of transport domain a vehicle can be traced, which requires the enabling of the location of the device. In all these cases the communication plays an important role.

Control and Automation:

In the connected world, the business and the customer have an option to control the devices, either directly or remotely. For example, a consumer can use IoT to unlock their car or start the washing machine. Similarly, IOT can be used to check the movement of people in a particular area. It can be done by configuring a sensor which can detect the movement and this can be done remotely ie automatically, by sitting in some other place.

Cost:

IOT is appreciated for automating the things and this would reduce the cost of the overall project.With new sensor information, IOT can help a company save money by minimizing equipment failure and allowing the business to perform planned maintenance. Sensors can also measure the driving behaviour, life style parameters, which can be used

to reduce the cost of fuel usage and suggest for a better living.

Structure of IOT

In this fast paced world, the need for security based systems has increased with time. Smart systems working automatically without human interference have found high demand. Such smart systems can be created with the help of IOT technology. IOT is an upcoming technology that makes use of Internet to control/monitor physical devices connected to the Internet. IOT gives the user the ability to control more than one digital thing easily through a comfortable GUI over the Internet.

Figure : Layout of an IOT system.

This paper makes use of an Arduino Uno board, which forms the basis of our IOT research. The Arduino[1] was built to reduce the cost of expensive boards, by Gianluca, with the help of David Cuartielles. They developed a cheaper hardware by using the ATmega8 [2]. Apparently this is the first "Arduino" prototype - dubbed Wiring Lite. Massimo Banzi designed this model of the Arduino. Arduino refers to an open-source electronic platform[3] or board and the software used to program it. Arduino is designed to make electronics more accessible to artists, designers, hobbyists and anyone interested in creating interactive objects or environments. An Arduino board can be purchased pre-assembled or, because the hardware design is open source, built by hand. Either way, users can adapt the boards to their needs, as well as update and distribute their own versions. A pre-assembled Arduino board includes a microcontroller, which is programmed using Arduino programming language and the Arduino development environment. In essence, this platform provides a way to build and program electronic components. Arduino programming language is a simplified form of C/C++ programming language [4] based on what Arduino calls 'sketches' which use basic programming structures, variables and functions. These are then converted into a C++ program.

The Arduino is connected with the ultrasonic sensor to transmit and receive data onto a serial monitor. The ultrasonic sensors[5] "are based on the measurement of the properties of acoustic waves with frequencies above the human audible range," often at roughly 40 kHz. They typically operate by generating a high-frequency pulse of sound, and then receiving and evaluating the properties of the echo pulse. Different sensors in market[6] are present in huge numbers but the ultrasonic sensors beat the competition big time. The setup of Arduino and the sensor are both interfaced using a breadboard[7].

To this setup an alarm is connected which sounds an alarm whenever an intruder enters into the range of the device which is detected from the ultrasonic sensor. The name of the buzzer is piezo buzzer[8]. Piezo buzzers are used for making beeps, tones and alerts. This one is petite but loud! It can be driven with 3-30V peak-to-peak square wave. To use it, connect one pin to ground (either one) and the other pin to a square wave output from a timer or microcontroller. For the loudest tones, keep the frequency around 4 KHz, but works quite well from 2KHz to 10KHz. For extra loudness, you can connect both pins to a microcontroller and swap which pin is high or low ('differential drive') for double the volume.

The above setup of Arduino, the sensor and the buzzer are further interfaced with the GSM module[9] or the GPRS(Global Packet Radio Service).

Components needed

	Model name	**Compatibility**	**Cost**	**Efficiency**
Arduino	Arduino UNO	-	1200/-	6 months*
Sensor	Ultrasonic Sensor	Compatible with any Arduino version	350/-	8months ^
GSM Module	SIMCOM 900	Compatible with Arduino Uno only	900/-	1 year*
WI-FI Module	ESP8266	Compatible with Arduino Uno only	160/-	1 year*
Buzzer	Piezo Buzzer	Compatible with any Arduino version	100/-	6 months
Jumper wires	Male to male and Female to male	Compatible with any Arduino version	2 /- (each)	Until broken

IOT BASED APPLICATIONS:

Some of the applications of IOT can be given as :

Smart Parking Monitoring of parking spaces availability in the city.

Structural health Monitoring vibrations and material conditions in buildings, bridges and historical monuments.

Noise Urban Maps Sound monitoring in bar areas and centric zones in real time.

Smartphone Detection Detect iPhone and Android devices and in general any device which works with Wi-Fi or Bluetooth interfaces.

Electromagnetic Field Levels Measurement of the energy radiated by cell stations and Wi-Fi routers.

Traffic Congestion Monitoring of vehicles and pedestrian levels to optimize driving and walking routes.

Smart Lighting Intelligent and weather adaptive lighting in street lights.

Potable water monitoring Monitor the quality of tap water in cities.

Chemical leakage detection in rivers Detect leakages and wastes of factories in rivers.

SYSTEM ANALYSIS

PROBLEM DEFINITION (EXISTING SYSTEM)

The existing system makes use of people, things, technology and security systems which turn up unreliable and cannot be trusted upon. There are certain CCTV cameras which are placed at certain locations in order to monitor flow of events at that place. The visuals from each of these CCTV cameras is projected onto a main system which requires to be monitored upon continuously hence increasing human interference. The current system also does not be trusted in places without proper lighting and places where severe power shortage occurs. In places without power backup during power cuts the entire system gets disconnected and needs to be restarted when the power supply resumes. This can be dangerous and requires continuous human intervention. Moreover, the cost maintenance of this system is high and hence this system cannot be accessible to the middle class and lower middle class people.

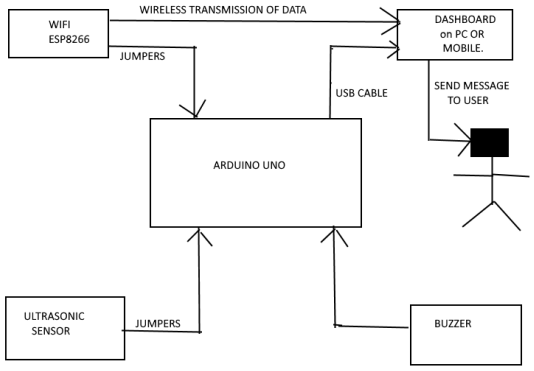
EXISTING SYSTEM DRAWBACKS:

No real time Alert .
No proper assurance of complete security .
Does not work at nights or during dark hours .
No police interference on the fly.

PROPOSED SYSTEM

The proposed system would be an automation of the security system. This system should raise an alarm, and send information to the owner and also to the cloud which may be used for some analysis at a later stage. The automation of the security system makes use of an Arduino Uno which is compatible with many of the physical devices.

SYSTEM ARCHITECTURE:



The system prepared by using the above mentioned components will also ensure that any unintended movement or action detected in the absence would project the details to the dashboard.

On detection of a movement, an alert will be sent to the registered mobile phone with the help of a GSM module and the Wi-Fi module helps project the intruder's pattern of movement on the screen called dashboard.

GSM Module:

This module takes the responsibility of sending a message to the registered user. It is done with the help of SIMCOM-900. It can send or receive messages from the registered mobile number. The main intention of using GSM is to provide an access to the user though his Internet connection is not active. To check the working of this GSM, a message can be sent and checking it on the serial window of the Arduino IDE.

Wi-Fi Module:

The purpose of this module is to send the information gathered from the ultrasonic sensor is sent to the cloud, so that it can be used for further analysis. To send the data continuously, using GSM would incur cost on the user. Instead, with the help of this Wi-Fi module, there can be a connection established between the cloud server and Arduino, by connecting to a Wi-Fi router. The Wi-Fi module that can be used is ESP8266. GSM module consists of a GSM modem assembled together with power

supply circuit and communication interfaces (like RS-232, USB, etc) for computer.

The cloud server which can be used is ThingSpeak[17] server. Thingspeak is a platform which provides various services exclusively targeted for building IOT applications. It offers the capabilities of
real- time data collection, visualizing the collected data in the form of charts, ability to create plugins and applications for collaborating with web services, social network and other APIs.

The core element of ThingSpeak is a 'ThingSpeak Channel'. A channel stores the data that is sent to ThingSpeak and comprises of the below elements:

- 8 fields for storing data of any type - These can be used to store the data from a sensor or from an embedded device.

- 3 location fields - Can be used to store the latitude, longitude and the elevation. These are very useful for tracking a moving device.

- 1 status field - A short message to describe the data stored in the channel.

To use ThingSpeak, we need to signup and create a channel. Once we have a channel, we can send the data, allow ThingSpeak to process it and also retrieve the same.

FUNCTIONAL SYSTEM REQUIREMENTS:

FUNCIONAL REQUIREMENTS:

HARDWARE REQUIREMENTS:

ARDUINO UNO.
ULTRASONIC SENSOR.
GSM MODULE
Wi-Fi Module "ESP 8266".
Piezo Buzzer.
Bread Board.
Jumper Wires

SOFTWARE REQUIREMENTS:

ARDUINO Integrated development environment(IDE)
Cloud to store data
IOT SIMULATOR PLATFORM (thingspeak).
Dashboard for data analysis.

RESULTS:

The following are the results expected from this work:

With the help of the incoming data from the ultrasonic sensor, the Arduino would be able to buzz the buzzer on detection of any un-intended movement and simultaneously a message would be sent to the user's phone number.

In addition to this the sensor data would be projected on the 'ThingSpeak' server with the help of a Wi-Fi module.

SCOPE: The work done in this paper can be extended from home security to vehicle security and from supermarket monitoring to data analysis.

CONCLUSIONS:

Security can be provided without the human intervention by automating the device using IOT. Here, any intrusion can be detected and also if the device is working or not can be verified using the information sent to the cloud. This information can be used for maintenance of the devices and also for providing the registered user with any information about the intrusion. Thereby, this system can find its applications in many fields such as home automation, office security system and so on.

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