

Arduino Based Prolonged Suspicious Inactivity Monitoring of Old Aged People

A Monitoring System for Old Aged People Staying alone in Apartments

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Abstract : The proposed framework includes the construction of a an astoundingly financially sharp and outrageous discernment device that fits at door frames in order to the moving in and out of a particular fundamental door of an old aged person and when suspiciously for too long the subject does not move out, it sends a notification to any of his family members or relatives about the matter to be of probable concern. It can be utilized in apartments as well as houses, where an old aged person lives totally alone, in case there is no caretaker and the adults of the family are staying apart, or even if children in their late teen age stay alone, or any solitary residents having potential medical or societal risks.

The project is based on the concept of the Internet of Things (IoT), run by an open-sourced hardware – a microcontroller integrated circuit in the form of a circuit board named Arduino-UNO, where the centralized controller is an ATmega328 P Controller. The system includes an Ultrasonic Sensor as the key sensor, and a GSM 900 Module as sender of SMS. When it is sensed that the person have not moved from the particular door, tentatively the washroom door, because it is a must, for quite a long time like half a day or full, it sends an SMS to the pre-loaded contact number.

IndexTerms - Monitoring, security, old-aged, remote, motion-detection, ultrasonic, IoT, arduino.

INTRODUCTION

Home automation is one of the leading fields that can influences people lives. Generally home automation systems aim at seeking luxury, but we target on those with special needs like disabled and elderly people. The aim of the proposed system is to provide security and monitoring of elderly people at home. This system is achieved by programming microcontroller and the quality of services is getting improved by automaton and Internet of Things.

With increasing population all over the world, the western culture, impact of Multinational Corporations, Globalization, selective urbanization and industrialization of some zones over other, economical gradient, and above all, for the search of employment, people have to move from one places to another as soon as they grow adults, and often they have situations leading to leave back parents who attain old age, and finally they have no person to look after them. Very recently there has been an increase in cases, such that, old parents lived in apartments, and their son returned after months, had to break into the apartments, and what they discover is decomposed body of the one parent who lived alone- unnoticed, and rotten. In the past few years, there are quite a few hundred such cases in countries like India, particularly in the megacities, where people live in apartments.

To overcome this problem, we have designed a small and handy device using ARDUINO-UNO, an HCSR04 Ultrasonic sensor, and a GSM 900 Module. The integrated system is proposed to be installed across a fundamental to-be-used door, like the washroom door that a person has to access. Such a door can only remain unaccessed for long time intervals like 12 or 18 hours when the person is terribly ill, or something worse have happened. In such cases, the system sends an SMS Alert to the associated contact number of his relative to check into the situation. This is a simple Internet of Things based project which can solve a lot of problem of the society, and make both the old people and their relatives in care feel safer, that too without any remote camera monitoring, this exposing no privacy of the subject.

The proposed system guarantees security, surveillance and solace to the user and make their life more comfortable. It detects the surroundings and act on the data, control home appliances, and has a smart digital/electronic door locking system by the help of image processing or a trigger by the user. This system will also provide intrusion detection notification and camera surveillance on mobile application. Smart home automation is proposed based on Arduino in Embedded C language, Arduino, and Android application. The motive of this wireless home automation system is to provide help to those with special needs. When system is designed for elderly or disabled person, it should be cheap, easy to configure, and easy to run with a good user interface. So, the proposed system is relatively simple to implement with user friendly interface.

AIM AND OBJECTIVES

a) Aim: The effort will lead to the creation of a highly economically practical and robust perception system which, in all probability, will understand human movement in front of it, and reset the timer every time the movement is desired. But, when there, for too long, no movement is observed, it sends a security SMS to the associated contact.

b) Objectives: The goal of this project is to build and create a monitoring device and wireless communication link to observe old aged people living alone without anyone to take care and convey an alert in situations of potential concern to the near and dear ones, and effectively reduce the number of horrible cases in metropolitan society of apartment-based lifestyle.

- To provide a sense of safety and trust to old people and solitary residents.
- To develop an extremely dependable system.
- Ultrasonic Sensors and GPS Remote Communication Module are used in the suggested system.
- Creating a low-cost and affordable system of monitoring.
- To create a monitoring system that includes no camera, thus respecting the privacy.
- To use a microcontroller kit which is open-sourced and can be easily accessed by any supplier or manufacturer.

LITERATURE REVIEW

GSM is a GPRS extension that allows for faster data transmission. The GSM module is primarily used to establish connection between the host and the GSM module. In this implementation, the host is a mobile Smartphone, and any data from the microcontroller is relayed to the user via wireless connection via the GSM module

To implement this we have to use Arduino and an Ultrasonic Distance Sensor together. To develop a high-efficiency system and wireless communications between devices, we can use software and hardware tools to implement this security system. The board has serial communication interface, including Universal Serial Bus (USB) on Arduino models that are also used for loading programmes from personal computers.

After detecting the situation, the system analyses and sends the appropriate alert to the connected relative. This can help to lessen the now-prevalent cases of unnoticed death and decomposition. The microcontroller has been programmed using C and C++ programming language. For monitoring and automation, the system has been integrated with Microcontroller, Sensors and GSM. The proposed system characteristics involve remote control of appliance and monitoring of solitary residents using GSM based wireless technology

EXISTING SYSTEM

There are many existing systems with solely security applications, which detects the motion, and sends an alert to the owner. Those systems, integrated with passive infrared sensors, or ultrasonic sections can be used to observe or restrict movements indoors or outdoors. It is utilized at homes or at the fields by the ranchers to detect any form of unapproved human richness with potentially unholy intentions.. But, there is no such system monitoring old persons who stays alone, and there will be no way to be noticed if they fall too ill to inform, as nowadays Cerebral internal haemorrhage and Cardiac arrests have become very common, even in case they pass away, there will be no one informed. Hence, this is the first and the only one of its kind.

PROBLEM STATEMENT

To plan a dependable device which will itself observe a solitary resident's activities, and will notify alert SMS in case, the inactivity persists for a suspicious period of time, and need not be checked in time and again for ensuring security.

PROPOSED SYSTEM

The Monitoring Device Using Arduino is an IoT based project. To execute the program code, we are using Arduino-UNO, for sensing the subject's activity of passing in front of the gadget, we are using the HCSR04 Ultrasonic Sensor, and a GSM Module as the remote communication system to send alert notification- all in a compact small device (Fig.1). It will create a bond of closeness among people with the help of technology. Everything is getting smarter with the help of technology, for the betterment of human beings. And in this situation, where employment and better career is leading to separate residences of parents and children, the last bit of communication gap will be fulfilled. So this will help in maintaining social positivity and personal safety with the help of emerging technology. It is a sensor-based device, easy to access for any age or economic groups it is made cost-effective to be accessible by a large number of people irrespective of economic capacity, as well as open-source, so that any supplier can work with it.

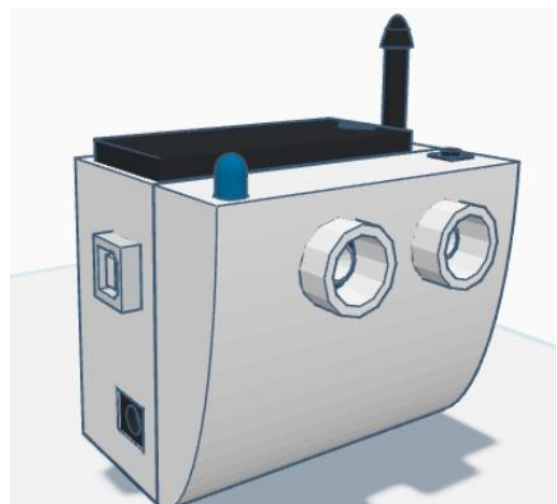


Fig.1: Proposed Model in 3D Drawing

And it should be usable to anyone and helpful for them.

To complete our project, we require the following software as well as the hardware components:

1. Software:
 - 1.1 Arduino IDE
 - 1.2 Tinkercad
2. Hardware:
 - 2.1 Arduino UNO Board
 - 2.2 GSM SIM 900 Module
 - 2.3 HCSR04 Ultrasonic Sensor
 - 2.4 RGB LED
 - 2.5 Jumper Wire

SYSTEM ARCHITECHTURE

Now, let me take you through the build-process of setting up the dustbin. Adjoined, is a photograph of our Prototype.

1. Ultrasonic Sensor Setup:

The HCSR04 Ultrasonic Sensor is placed in front of the device, facing the path of the subject's movement. It should be placed parallel on the front face, preferably only the two Ultrasonic emitter and receiver peeping out of the body. The four pins are connected VCC to 3.3V VCC, GND to GND, and Trig and Echo to two digital pins of the Arduino UNO Board.

2. Setting up the GSM Module:

The GSM SIM 900 is a GPRS Module which requires a Macro-SIM to be installed in its SIM slot. The Antennae is connected and screwed up. The power cable pair is plugged in and the pair of red and black wires is plugged with the VCC 5V and GND of the Arduino UNO Board appropriately. The Rx and Tx pins of the GSM is connected to two digital pins in the board.

3. RGB LED Setup:

The RGB(Red-Green-Blue) Light Emitting Diode has four pins. The RGB is to peep out of the body through a small opening, preferably at the top. It has four pins, the longest being the cathode, which is to be connected to the GND pin beside the row of the digital pins. The pin for Blue is connected to a digital pin, that is to be switched on when there is no judgement, but the system is running. The Blue light is although optional. The Green and Red light pins are required and are to be inserted into two digital pins, programmed to glow up green, when there is a movement, and red, where there is no movement for the assigned long time.

4. Wiring Up:

The last step in the build-process is to make the intended connections using suitable connectors, specifically jumpers, as per the circuit-diagram and fastening these connectors to ensure; they don't hang around and can be used safely and conveniently. All the jumpers from the Ultrasonic Sensor, the GSM Module and RGB LED are connected to required pins of the Arduino-UNO. This completes the entire build process of the Monitoring Device for Solitary Residents.

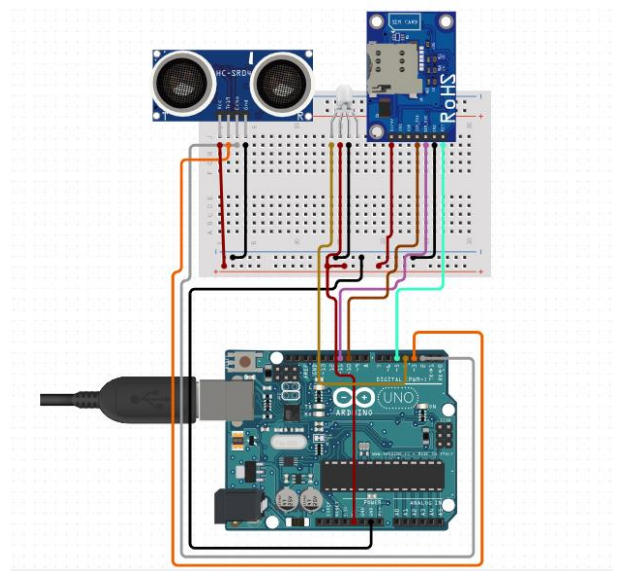


Fig.2: Circuit Design

Now, all the equipments are to be properly set up inside a compact body, which will be small, and handy to use. The body should have required openings for Sensors, LED, power and data cable plugs, and the SIM slot.

DESIGN DETAILS

The circuit design has been given in the diagram provided alongside (Fig. 2) . This is how the connections are to be made to make the system successfully functional. The usage of the breadboard and the connection to the blue light pin of the RGB LED are both optional, and depends entirely on convenience of setup, and compaction of module.

Methodology

- Human Detection:** The process is an infinite flow which starts from an interference detected by an Ultrasonic Distance sensor. The signal is generated when a motion is detected, and the signal is directed towards Arduino which keeps continuing the loop until it feels, that for an abnormally long time, no movement have been detected.
- Conveying the Alert :** This system is specially design for if there are movements in a place where an aged person will certainly go time and again during the day, like the washroom. When PIR sensor detects no motion, for the given amount of time, like for 12 hours, the signal is send to Arduino which activates the GSM Module and a notification is sent to the assigned mobile phone.

ALGORITHM

After we have set up the device mechanism, we will now head-on for the code it will execute. We simulate the working of the hypothetical code in Tinkercad Circuits, preferably in blocks. Then we go for the final code to be uploaded in the firmware. Arduino is coded in Arduino IDE, offered by Arduino.cc in C++ Language. Keeping efficiency and speed in mind, we have to use the code for our Arduino. The code is then uploaded to the firmware with the help of a USB cable type A/B.

The Algorithm on which the code will be based, for the working of the system, has been given by the flowchart (Fig.3) alongside. It will keep checking for movements in loops and if no movement is detected, the time interval of each check is added up and if there is any movement detected, the time is set to zero. The frequency of cheking can be set easily, with the delay() function, providing the time period in milliseconds as argument. In case, the time exceeds the given time, here 12 hours, the loop is broken, and the SMS alert is sent with the help of the GSM. While coding, we will first include the <GSM.h> library, and call the statements we will use, like GSM gsmAccess and GSM_SMS sms.

We then need to define the Ultrasonic sensor's functioning. We then adequately set up the system under void setup() function, defining default digital pin for LEDs and code the GSM initialization. We then proceed for the void loop() which contains our algorithm, coded in C++, and saved with the extension, '.ino'.

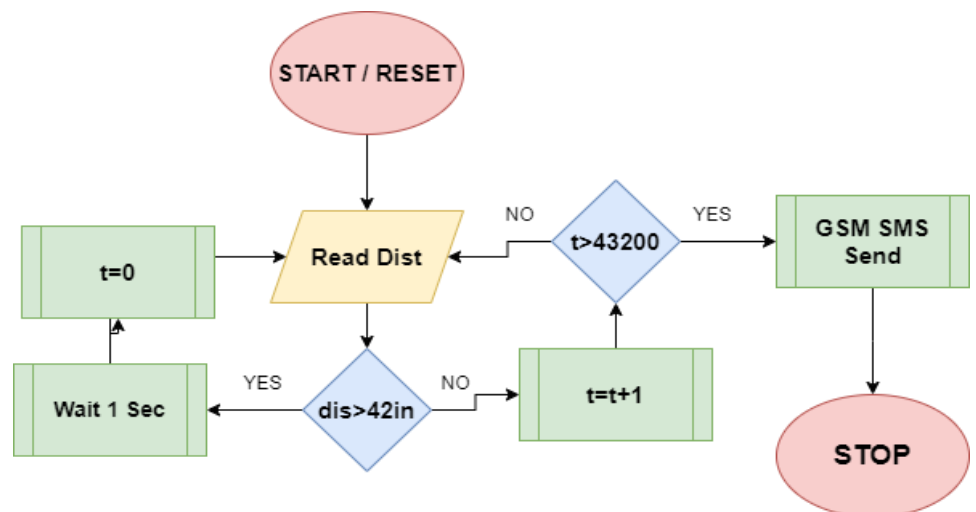


Fig.3: Algorithm flowchart

The main components of the system are:

A. Arduino UNO

It is an open source microcontroller board which works on the microchip ATmega328. It has numerous facilities to communicate with other devices. It acts as an electronic platform based on easy to use software and hardware making electronics designers and developers more accessible.

B. GSM Modem

GSM modem is a type of modem which accepts a SIM card and it acts like a mobile phone with its own unique phone number. It has RS232 port so that we can communicate and also develop embedded applications.

C. PIR Sensor

Passive Infra-Red or PIR sensor is detects the motion. It detects the motion by varies the infrared level that emitted by objects.

D. IP Camera

Camera which capture the image and that receives control data and send images through the Internet. It is used for surveillance and image processing.

Conclusion

The proposed system has a unique smart surveillance system based on IoT that will help the elderly or disabled people by providing proper security. The system consists of human detection, visitor and user interaction, controlling of home appliances, door unlocking system and monitoring system which are controlled by Android application.

RESULT

The Arduino Security System could be a technology that detects such motions using ultrasonic obstacle sensors. This gadget has been made for monitoring old aged people staying alone in houses and apartments. As a knowledge processor, it uses an Arduino Uno. The information is processed and the situation is judged by Arduino based on the inputs from the ultrasonic sensor. The sensor reads if anyone passes from in front of it, and in case, the movement is missing for a suspiciously long period of time, an alert SMS is sent to the relative of the subject in their mobile phones. When the ultrasonic sensor detects something, all it gives is whether there is someone in the assigned range. However, a lot is going on within and the sensor's input and output is reliant on several functions and variables. The Ultrasonic sensor emits a sound of above audible frequency, and it waits for the vibration to come back to the receiver, thus, calculating the distance free in front of it, by counting the time of emissions versus the time it took to be reflected back. After the entire setup, and the placing the ultrasonic sensor at the desired location, we have the final prototype ready.

ADVANTAGES

This device is a unique one, the only of its kind, and is expected to prove itself to be a very useful and revolutionizing device, one, that aids cure to one of the problems of apartment-lifestyle with one of the most horrible and scary outcome. The motion sensor enables us to detect movement of our near and dear ones, and in all probability, the worst situations that can happen in one's life, even if the one staying alone is unable to inform, this device will surely inform their relatives. The people will feel entirely safe about themselves, and the close ones won't have to check in time and again in their busy schedule. Some of its most prominent advantages are as follows:

- Small, compact and handy.
- Very cost effective and easy to manufacture.
- Easy to interface.
- Uses open-sourced microcontroller, making it easy for suppliers to manufacture and supply.
- No wearing out.
- Gives assurance and feeling of security among people staying alone.
- Will surely help in reducing unnoticed death and decomposition cases.
- A support to modern lifestyle.

CONCLUSIONS AND SUGGESTIONS

We have presented a method for making a monitoring device for solitary residents. It can be used in a variety of reasons, for persons of all ages, staying alone in apartments, specifically for the old people. A motion monitoring system based on Arduino technology has been built in this project. To monitor one's motion, we have to place the device in a place, across a door which the person will pass through, for sure, in the entire time period. A person living alone, without any caretaker, will surely go to use his/her washroom multiple times a day, and hence, it is suggested to install the device beside the washroom door. As the subject going in and out, his/her movement is detected. We also need to make sure that the SIM card is recharged from time to time, and kept active.

The potential case of concern due to prolonged inactivity of a person can be detected using this technology. It ensures a high level of efficiency, and instills a sense of safety and confidence to those who might feel lonely or left out, staying alone. Long distance warning alerts can be sent, across the globe and a potentially bad consequence can be avoided. It is sure to make changes, omitting the insecurity of modern settlement, and make people feel free to move on for their career and causes, once they confide in the device. It will take care of our loved ones like a loved one.

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