

An Internet of Things Based Smart Surveillance and Monitoring System using Arduino

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ABSTRACT: Nowadays security is a major concern and it is growing rapidly. It is important for all to save their property, documents, money and other important things. With the growth of technology, the methodologies used by criminals are equally improved. Therefore, it is important to improve necessary surveillance techniques with the global change. The latest and effective technology used against the robbery and theft are video surveillance and monitoring system. But the cost of installation and maintenance of these systems becomes impossible for some people to afford. Arduino Mega 2560 is a micro controller board that has the capability to become a camera system when its own mini module known as Arducam gets attached to it. Instead of implementing various complex algorithms, a new and effective methodology has been developed for motion detection which is to use Pyroelectric infrared (PIR) sensors. Whenever the motion is detected by the PIR sensor, it captures the image with the help of connected Arducam and sends the push message to android using Firebase API. Further the user can control the arduino from the internet using the Near Bus concept (Rather than the customary idea of "associate" a remote gadget to the cloud (to control it), the Near Bus system "maps" the gadget into the cloud, completing a reflecting (or replication) of little piece of the miniaturized scale controller's memory into the cloud memory [1]. By using this methodology, cost of installation can be reduced and it is energy efficient system.

KEYWORDS: Internet of Things, Motion Detection, Firebase, Arducam, PIR Sensor, Arduino Mega 2560

I. INTRODUCTION

IoT is the associated system of physical devices, home appliances, and all other electronically embedded items, software, sensors which helps them to exchange data and information. Internet of things by and by is being used as a piece of the fields of autos, cultivating, security surveillance, building organization, adroit homes, and human administrations. The IoT suspects to use insignificant exertion enlisting devices where there is less imperative usage and obliged impact to the earth.

According to Gartner Inc.(world's driving exploration and warning organization), there are roughly 8.4 billion gadgets associated with web worldwide in 2017 which is 31 percent more than in 2016 and will achieve 20.4 billion by 2020. IoT alludes to vast assortment of gadgets like different

sensors that measures circulatory strain, pulse, beat rate, feeling of anxiety, sensors that distinguishes movement and numerous other bio chips. A road wrongdoing is the issue with which relatively every administration needs to bargain. The Closed-Circuit Television (CCTV) have been utilized for monitoring, recording and getting mainstream in entire world. CCTV frameworks will help location through its observation ability. Reconnaissance by utilizing CCTV frameworks sending information like pictures through web to servers however coupling these two observation and information transmission forms is an extremely troublesome work. utilizing CCTV frameworks information has a security issue or exceptionally test to deal with. That can't be utilized at high scale where security issues are progressively or hard to deal with. Additionally, the constraint of CCTV cameras while ongoing frameworks give a prompt reaction to wrongdoing discovery and the aversion [2]. Web of things (IOT) is an idea that is a going improvement of the web by which ordinary 'things' objects have correspondence abilities which enable them to send and get information through associations remote or wired and extraordinary tending to plans to make new applications/administrations and achieve shared objective. Specifically, IOT is another worldview in software engineering that goes for misusing the data about nature state keeping in mind the end goal to customize it, that is to adjust the earth to the client inclinations. The goal of the IOT is to enable everything to be associated at whenever, wherever, with anything in a perfect world utilizing system. IOT innovation can be made another thought and wide advancement space for shrewd houses to give insight and to enhance the personal satisfaction [3]. IOT based application can be used remotely to view the activity and get notification when motion is detected. Several applications will be presented, which are important to envisage some of the potential IOT. Some of these applications are: smart cities, smart energy, smart grid, agriculture and breeding, and pharmaceutical industry [4].



Fig 1: Connectivity through IoT

Communication: The fundamental intension of IOT is to give a correspondence among the physical gadgets, frameworks and individuals. Every single space needs the trading of data in a single manner or the other. For instance, the therapeutic space the data about the patients, now and again the basic data must be sent, so a quick move could be made. The basic data as either circulatory strain or the beat rate could be estimated with the assistance of sensors. If there should be an occurrence of transport area a vehicle can be followed, which requires the empowering of the area of the gadget. In every one of these cases the correspondence assumes an essential part.

Control and Automation: In the associated world, the business and the client have an alternative to control the gadgets, either straightforwardly or remotely. For instance, a customer can use IoT to open their auto or begin the clothes washer. Additionally, IOT can be utilized to check the development of individuals in a specific territory. It should be possible by arranging a sensor which can identify the development and this should be possible remotely ie consequently, by sitting in some other place.

Cost: IOT is refreshing for mechanizing the things and this would diminish the cost of the general project. With new sensor information, IOT can empower an association to save money by constraining equipment dissatisfaction and empowering the business to perform masterminded bolster. Sensors can similarly evaluate the driving behavior, lifestyle parameters.

Structure of IoT: In this quick paced world, the requirement for security-based frameworks has expanded with time. Keen frameworks working naturally without human impedance have discovered appeal. Such keen frameworks can be made with the assistance of IOT innovation. IOT is a forthcoming innovation that makes utilization of Internet to control/screen physical gadgets associated with the Internet. IOT enables the client to control more than one computerized thing effortlessly through an agreeable GUI over the Internet. This paper makes utilization of an Arduino board, which shapes the premise of our IOT look into.

The Arduino was worked to diminish the cost of costly sheets, by Gianluca, with the assistance of David Cuartielles. They built up a less expensive equipment by utilizing the ATmega8. Evidently this is the primary "Arduino" model - named Wiring Lite. Massimo Banzi

outlined this model of the Arduino. Arduino implies an open-source electronic platform or board and the item used to program it. Arduino is proposed to make devices more open to masters, architects, specialists and anyone enlivened by making instinctive things or conditions. An Arduino board can be gotten per-gathered or, in light of the fact that the hardware arrangement is open source, worked by hand. In any case, customers can modify the sheets to their requirements, and furthermore invigorate and scatter their own variations. The pre-collected Arduino board incorporates a microcontroller, which is customized utilizing Arduino programming dialect and the Arduino improvement condition.

II. LITERATURE SURVEY

A number of assessments on the theme of Wireless-Sensors methods were done before as projects reports or, as research papers on IoT based motion detection.

Atzori, et al [1] presents that at the point when a protest (characterized by a distinction in luminance from its environment) moves, the movement can be recognized by a generally basic movement sensor intended to recognize an alteration in luminance at one point on the retina and interface it with a conceded change in luminance at a adjacent point on the retina. Sensors that work along these lines have been alluded to as Reichardt detectors.

Rayte, et al [2] represents the essential thought behind the vitality show is to manufacture spatio-transient channels which are arranged in space-time and accordingly coordinate the situated space-time structure of moving spatial examples. This is refined by including space-time distinguishable channels. A detachable channel is one in which the spatial profile continues as before shape after some time yet is scaled by the estimation of the transient channel. For every course two space-time channels are produced one which is symmetric (bar-like) and one which is asymmetric(edge-like). The entirety of the squares of these channels is known as the movement vitality. The distinction in the flag for the two headings is known as the adversary vitality. However, the reaction of this framework will likewise rely on differentiation thus the outcome must be isolated however by the squared yield of another channel which is tuned to static difference. This gives a stage free measure which increments with speed however does not dependably give the right speed esteem. The model can represent various movement marvels.

Piyare, et al [3] accessed and defines the typical workflow of an infrared motion detection sensor. The different sort of movement indicator had clarified in area above and infrared was decided for this undertaking. This in light of the capacity of sensor to work, effortless to get the extra part segment and quick to work with considering the length of undertaking is in here and now. This segment will expand more insight about infrared movement indicator. Infrared sensor likewise surely understood as an electro-optic identifier retains electromagnetic radiation and yields an electrical flag that is generally corresponding to the irradiance (power of the occurrence electromagnetic radiation). Contingent upon the kind of indicator and the manner by which it is worked, the yield flag can be either a voltage or a current.

Prasad, et al [4] proposed the concept of reflected radiation. The radiation exuding from a surface incorporates not just that produced by the surface yet additionally that reflected by the surface. The articles encompassing the surface in question additionally transmit radiation in ghostly conveyances fitting to their individual temperatures. This radiation, or if nothing else some bit of it, is episode on our surface of intrigue where it is incompletely consumed and in part reflected. To a spectator the reflected radiation is undefined from the discharged radiation. An IR producer is a LED produced using gallium arsenide, which emanates near IR vitality at around 880nm. The IR photo transistor goes about as a transistor with the base voltage directed by the measure of light hitting the transistor. Henceforth it goes about as a variable current source. More prominent measure of IR light reason more noteworthy streams to course through the authority producer leads. The photo transistor is wired in a comparable arrangement to the voltage divider as appeared in the outline underneath. The basic cause of a voltage drop in the draw up resistor is the variable current going through that resistor. This voltage is estimated as the yield of the gadget.

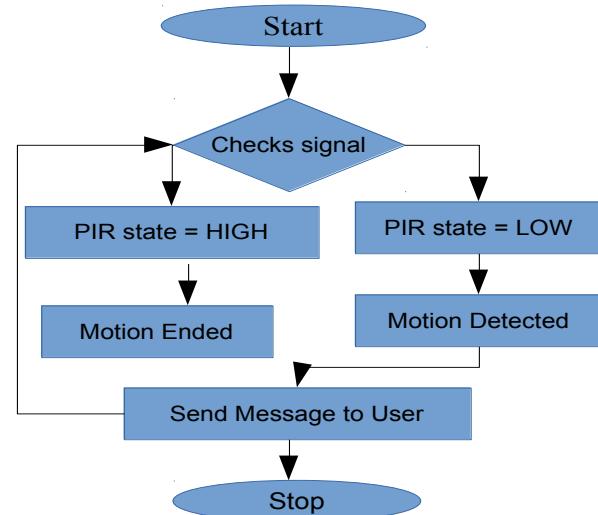
III. PROPOSED IDEA

This paper portrays how to actualize IoT Push notices. Utilizing IoT push notices, a person can send warnings to different gadgets. For this situation, this need to send an IoT push notices from a keen question (like Arduino Mega 2560) to a portable cell phone (i.e. Android cell phone). This task incorporates distinctive Eco-frameworks: IoT and Android. This venture can have a few usage: for instance, we can send a drive notice to our cell phone when an alarm happens:

- Leakage of Gas
- Detect Motion
- Temperature variance
- General failure in Electronic Systems

we will utilize a movement recognition sensor. There is an Arduino Mega 2560 associated with a PIR sensor. At the point when the sensor triggers an occasion, at that point Mega 2560 makes a call to Fire base server utilizing Fire

base API. With API, the shrewd protest sends IoT push notices to an Android cell phone. We can utilize a similar



route, to send notices to different gadgets like iOS etc. This motion detection system is made using Arduino Mega 2560 board and PIR sensor, it will detect any movement around it. If it detects any movement, a message will sent to the android smartphone using Firebase API in Android application. All this will be possible only with coding and applying automated code using different programming languages.

Fig 2: Work Flow of Push Notification from Arduino Sensor to Android Smartphone

IV. PROPOSED METHODOLOGY

- i) **Arduino Mega 2560 PIR PROJECT:** The first step is to connect the Arduino Mega 2560 board with the PIR sensor by attaching the wires between the pins of Arduino Mega 2560 board and PIR sensor. All the things are connected to Electronic breadboard. If we want to know that PIR sensor detected a movement then we have to check the signal is 1. We have to check the signal on the input pin which should be 1. If it is 1, then we have detected a movement and we are ready to send the notification.
- ii) **Mega 2560 WIFI CONNECTION:** Before we send the notification, we have to make sure that the Arduino Mega 2560 board is connected to internet using Wi-Fi. We modify the existing code and add the WiFi connection part in it.

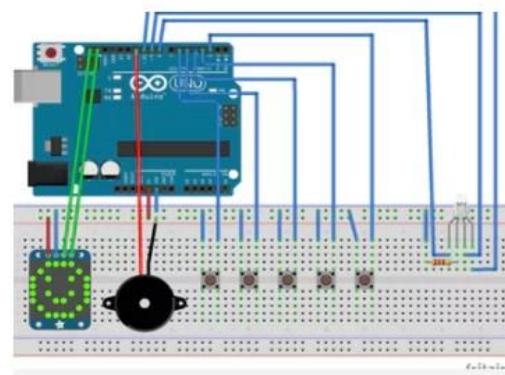


Fig.3: Mega 2560 Wi-Fi Connection

iii) Sending IoT Push Notification : We use the Firebase API to send a push notification, to do that we first have to create a project in Firebase console. To send a push notification utilizing Firebase it is important:

- Client Authentication
- Message Body Creation in JSON
- Send notification message to a smartphone

iv) Coding: This motion detection system is made using Arduino Mega 2560 board and PIR sensor, it will detect any movement around it. If it detects any movement, a message will sent to the android smartphone using Firebase API in Android application. All this will be possible only with coding and applying automated code using different programming languages. Features of Proposed idea and methodology:

- It is very cheap and affordable to customers.
- The maintenance cost of this very system is very low.
- This is system is very easy to use.

V. COMPONENTS USED FOR THE IMPLEMENTATION OF THIS PROJECT

i) Arduino Mega 2560: Mega 2560 is WiFi enabled board which is small in size and has the capabilities of built-in WiFi. It is perfect addition to any Arduino project. It contains SAMD21 Cortex-M0+ 32bit low power ARM MCU Micro-controller, 5V(USB/VIN) board power supply, Li-Po single cell battery. Its operating voltage is 3.3V.

ii) PIR Sensor: A Passive infrared sensor (PIR sensor) is an electronic sensor that permits to recognize movement or any development. A PIR sensor used to recognize whether a human has moved in or moved out of the scope of sensor's range.



Fig. 4: Typical commercial PIR-based motion detector (PID)

VI. EXPECTED RESULTS

Using the project, we intend to provide an easy and better way to detect motion in everyday life. User gets to know

that plant needs to be watered. User can control everything from even the other part of the world and make the best of his time. Many aspects can be customized according to the needs of the user. We can automate the whole process if the user will like to have it. As soon as the sensors gets information regarding the motion detection it sends a push notification using fire base. Executing the Arduino code with Hardware successfully yield the results as indicated above. It can be depicted that the range of detection of the PIR sensor varies at different sensitivity levels. The higher the sensitivity of the sensor the higher the range of detection can be safely said that the PIR sensor formed the primary motion detector and hence the first line of defense. The various modules exclusively relied upon the PIR State to go HIGH. On the off chance that this sensor falls flat, the entire security system as outlined should come up short. It can be deduced that varying the pixel threshold of the camera achieves the action of detection and tracking. However, detection occurs only within some limits. Motion detection and tracking was achieved.

Why Using Arduino: It is versatile, offers an arrangement of advanced and simple sources of info, SPI and serial connection & computerized and PWM yields. It is definitely not hard to utilize, partners with PC by methods for USB and bestows using quality connection tradition, keeps running in independent mode and as interface related with PC/Macintosh PCs. It is efficient, around \$30 per board and goes with free forming programming. It is an open-source wander, programming - H/W is to an awesome degree accessible and to a great degree versatile to be changed and extended. Arduino is maintained up by a creating on the web gathering; loads of sources are currently open.

Software Communication with Arduino Interface: The Arduino can "talk", (transmit or get data) by methods for a serial channel, so some other device with serial capacities can talk with an Arduino. It does not have any kind of effect what programming vernacular is running the other equipment. The Arduino's "central" serial port can either be used, the one it uses when you "talk" to it to program it, or you can leave that channel focused on programming (and the change condition's serial screen), and use two unique pins for an extra serial association focused on the external device. A couple of activities (like Streak) don't have nearby serial limits. They can at give speak Arduino through a center individual which, like a "mediator", enables them to talk with each other.

Previous Methodology: Human interruption can be identified utilizing numerous sensor modalities. Six sorts of sensors are incorporated and these are aloof as in, dissimilar to radar or ultrasonic sensors, they don't emanate a flag and perceive how targets alter it. Uninvolved sensors are favored in sensor systems where there is constrained vitality. Attractive sensors expect that the gatecrasher, for example, an equipped individual, has attractively delicate

material. Ferromagnetic substance makes a particular attractive mark that can be distinguished utilizing a magnetometer. Vibration-based reconnaissance sensors can be characterized into two noteworthy gatherings, to be specific, acoustic sensors and movement sensors. The sound created by the element that will be recognized or checked can be measured by acoustic sensors. On account of vehicles, the fundamental wellsprings of sound are motor and power-prepare clamor, track/tire commotion and fumes commotion. Strides of people and creatures, vacillating of wings by feathered creatures, and so forth., likewise produce sound notwithstanding the element's vocal sound. Receivers and Hydrophones are the sensors that measures sound. Then again, vibratory movement sensors sense relocation, speed and increasing speed utilizing seismometers/geophones, velometers and accelerators, individually. The two classes of sensors are having nearly the same physical development: they contain a spring limited mass which definitely will make them sodden. In any case, the recurrence, scope of activity and determination of these sensors will be altogether extraordinary. Their cost likewise shifts relying upon their level of sophistication^[5]

VII. CONCLUSION

The project designed and implemented a security system based on the Arduino. The aspects of the system are: motion detection using a PIR sensor, video capturing using a Arducam Camera and sending out an alert through Firebase Push Notification to Android Smartphone. Security can be given without the human intercession via mechanizing the gadget utilizing IOT. Here, any interruption can be identified and furthermore if the gadget is working or not can be checked utilizing the data sent to the cloud. This data can be utilized for support of the gadgets and furthermore for giving the enrolled client any data about the interruption. In this way, this framework can discover its applications in many fields, for example, home computerization, office security framework.

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