

# Automated Digital Letterbox System Using IoT & Android – A Survey

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## ABSTRACT

*This system presents a low cost, less time consuming, safe and effective implementation of Automated Digital Letter Box System through the wireless sensor networks which makes the use IR sensor. A hardware kit is realized and designed for this purpose. IR sensors has IR transmitter and IR receiver. IR transmitter transmit the rays. When the rays fall on to the object then it gets reflected to IR/PIR Sensor, it results that the object is detected. In this system user is notified by sending a text message through a SIM card and Android Application which gives the notification through the internet. Fingerprint sensor has connected to hardware kit so only authorised user will get own letter. Using NFC tag only authorized person can drop letter. Also postman will get acknowledgement receipt. The paper illustrates the description of this device, the android application which receives the notification also user can check log of Letterbox on application. This system reduces the Human efforts. The final aim is to minimize the human efforts, reduce cost.*

**KEYWORDS:** IR Sensors, Fingerprint, NFC tag, GSM/GPRS module.

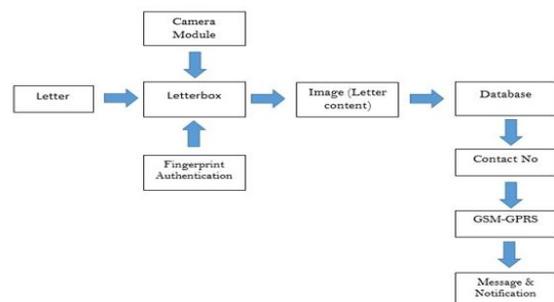
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## I. INTRODUCTION

In the current scenario we use conventional letterbox system, In this system postman posts letter in the letterbox and goes. Then we need to check letterbox every time whether the letter is arrived or not? It consumes human efforts as well as time. When we are not present at home then inconvenience occurs. Also this letterbox has no security.

In the view of ‘Smart City’ we decided to develop advanced automated digital letterbox. Which will help to automate the conventional system. The automated smart letterbox will be developed for receiver who will receive letter arrival notification on android application through text message as

well. Using this system individual client will get its own letter. User will able to read letter on mobile. User can check log of letterbox on mobile application. Only authorized person can open this letterbox.



**Fig 1:- Block Diagram of Proposed System**

It will benefit to society, system will be more advanced, more convenient to use, efficient, high secured, easy to use it will reduce human efforts.

## II. LITERATURE SURVEY

### A) Tracing Path with Arduino Uno using GPS and GPRS/GSM

In today's world, information could be brought in your mobile when you are on move. With the help of GSM (Global System for Mobile Communication) and GPS (Global Positioning System) technologies path can be traced. Tracing path in real time would give the confidence and peace of mind when visiting a new place. Technology behind designing of most of the tracking system is GPS/GSM [1]. Location is the most important in tracking systems. Using GPS technology, the information about location is provided anytime and anywhere on earth [2]. The coordinates about the location of the user is provided by the GSM modem by sending SMS to the hand-held device through GSM network [3]. Due to its low operation cost, the utilization of SMS as wireless service has become popular. Transferring and receiving of data is convenient and accessible due to its high reliability.

Interfacing between Arduino R3 microcontrollers, GPS, GSM modem for real time path. (ii) Transferring the GPS data to GSM modem and delivering the coordinate to the mobile phone for displaying the path using Google Maps.

## III. BACKGROUND

**A. Android:** Android is Linux based open source Operating System developed for hand held devices. Android was developed by the Open Handset Alliance, led by Google [5]. Android gives a platform for application development for mobile devices which means developers need only to develop application for Android, and their applications will run on different devices powered by Android Operating System. Android studio is the IDE used for the development of application. Under Apache License 2.0, it is freely available. ARM architecture is the main hardware platform for Android. There is support for x86 from the Android x86 processors [7], and Google TV uses a special x86 version of Android.

**B. Global Positioning system(GPS)** Location of the receiver is determined by the data from the microwave signal that GPS satellite transmits to GPS receiver. The current location of the user is determined by the information provided by the GPS satellite. With the help of GPS, the current location

and path traveled can be traced. The operating mode that is used is a two-dimensional GPS that includes two horizontal coordinates namely longitude, latitude. To get a coordinate minimum three visible satellites are required. The receiver gets the signal from GPS satellites. The GPS



Fig 2: Map on Android Application

satellite also transmits the location of the satellite in the orbit to the GPS receiver. With all information received from the satellite, the GPS receiver can determine the position in three dimension namely east, north and altitude. The GPS satellites have the atomic clock.

Later, the number of satellites were increased to 32, to improve location accuracy. 4 GPS satellites were located in each of the 6 orbits with 60 degree orientation between each other. These orbital planes do not rotate with respect to any star.

**B. GPRS/GSM SIM 900:** The General Packet Radio Service is the packet-switched service. It is the extension of GSM and was developed to facilitate access to IP-based services compared to existing circuit-switched services provided by GSM. GPRS is a best effort service based on packet switching, where throughput and latency depends on the traffic in the network, as opposed to circuit switching, where a certain quality of service (QoS) is guaranteed.

GPRS/GSM SIM 900 device It is Arduino compatible GSM/GPRS shield. It uses SIMCom SIM900A module and of very low cost. It is provided with the SIM card slot. By putting a SIM card on this shield, shield connects Uno board to the internet using the GPRS wireless network. It has

the following features: x Dual-Band GSM/GPRS 900/ 1800 MHz x TTL data (RX, TX, GND).

Now a days, Arduino due to its user friendly and easy to use setting are used a lot in microcontroller [8] programming, like any microcontroller, an Arduino is a circuit board with chip that can be programmed to do numerous number of tasks. It sends instructions to the Arduino microcontroller through the computer program written in sketch and finally it is the microcontroller that controls the circuit or machine with multiple circuits by executing the specific commands [8].

### B) Real-time Online Attendance System Based on Fingerprint and GPS in the Smartphone

Real-time online attendance method is helpful for workers who do a lot of activities outside the office or workers with multi-schedule. The attendance system using online biometric fingerprint system will reduce the problems caused by manual system usage such as lags in data management. The purpose of the research is to constructs an online presence system that combines fingerprint modules and GPS. The ZFM-20 fingerprint module is used as the system's main input as well as a security tool as an entrance to get access to the entire system[11]. GPS module is applied to determine the user's location and sends it to the smartphone. Arduino module in the system will send a text message to the parties concerned about the user's location data automatically. Each module works well and testing the entire system showed the system work reliable according to the initial scenario. The User can access the report using SMS, website, and application on the Android smartphone. The fingerprint sensor can determine the fingerprint stored in the database with an average response time of 1.39 seconds, and GPS can determine latitude and longitude with an average error of 0.007352% and 0.0003% respectively[12].

Users must install APK files on their smartphones and set up office coordinates and their fingerprint input to the system. When users log in using fingerprints, the data will automatically be sent to a database that can be accessed from anywhere via the Android application, through the website and automatically sent via MMS (Multimedia Messaging Service) to a related party as part of the personnel in the office. The initial stage in design is to analyze the equipment required for the detection of fingerprint GPS-based with Arduino, which is preparing the hardware and software.



Fig 3: System Design

This research produces an attendance system that can be accessed by SMS / MMS, website and with application in android. The built system is capable of displaying the ID, Name, Time absence, and Location where the user is accessing the device[13]. The system also displays the Export to Excel feature to facilitate the process of downloading data from the database.

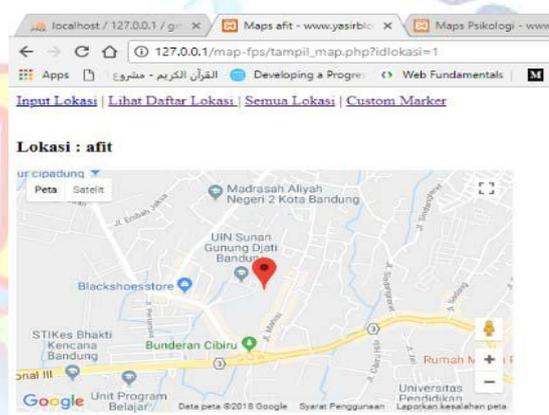


Fig 4: Monitoring the absence system by website

### I. Existing Project Implementation:

Fingerprint ZFM-20 Module Testing is done to know the ability of recording data in fingerprint module in fingerprint scanning. The fingerprint should be able to distinguish some of the fingerprints listed on EEPROM and fingerprints that have not been registered in the system. In this test, the registered fingerprints are five fingers of the right hand as ID 0 through ID 4, for comparison using a left-hand finger that has not been registered. In addition, testing of the time required to perform scanning. Based on the timed datasheet should be less than 1 second. Table 1 shows the testing of the fingerprint module using the right and left hand as well as with the outcome in the Arduino monitor series[14].

### C] Arduino-based Wireless Motion Detecting System

This project aims to help the public in protecting and avoiding criminal cases that are likely to occur in their neighbourhood. Such cases occur when the occupants are not at home or possibly even occur when the occupants are in the house. Intruders can unlock the house unknowingly by anyone. The Arduino Security System is a technology that uses PIR (Passive Infrared Sensor) sensors to detect such motions. This device has been created for home security systems. It uses Arduino Uno as a data processor[8]. When the PIR detector detects movement, Arduino processes the data and triggers an alarm. At the same time, Arduino will also send the data via Wi-Fi modules to users via applications that have been uploaded to a user's smartphone. Only homeowners can turn off the alarm system using a smartphone. The connection between the application and the circuit is connected using a Wi-Fi module. The application of this detector system can be a suitable security system in accordance with the current development.

**I. Application of Wireless Motion Sensor System:**

This system was developed as a result of the combination of existing systems that have been modified to facilitate users. The system used ESP8266 NodeMcu Wi-Fi module technology to transmit data to the users through applications developed. The sensor system used was the same as the previous one which is the PIR sensor to detect the movements within a specified distance. Communication between user-shared circuits was through the application developed and connected using Bluetooth module[9]. Overall, the system to be developed has its own advantages and disadvantages depending on certain aspects. One of the advantages that can be stated, is that this system can send data to users through the application system that has been uploaded to user's smartphone.

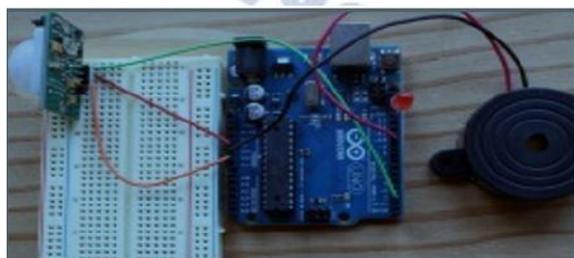


Fig 5: PIR sensor arduino.

**II. Arduino Circuit Design:**

Figure 6 illustrates the Arduino circuit interface that has been created for this project by using the Fritzing software. Arduino circuit was designed to

detect movement. Components used were Arduino Uno R3, ESP8266 NodeMcu Wi-Fi module, alarm, Red Light Emitting Diode (LED) and PIR Sensor[10]. The connection between these components did not require soldering but requires sufficient jumper wires.

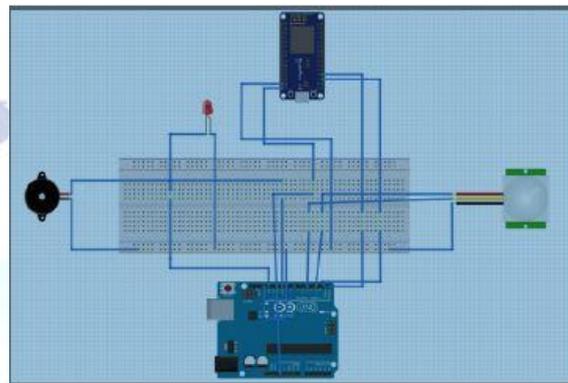


Fig6: Arduino circuit interface.

From the figure, the design board was used to facilitate the components that were connected to the Arduino pins. The components used must be connected with the Male-Male jumper wire or Male-Female jumper wire in order to connect to the design board and the Arduino involved.

**III] Proposed System**

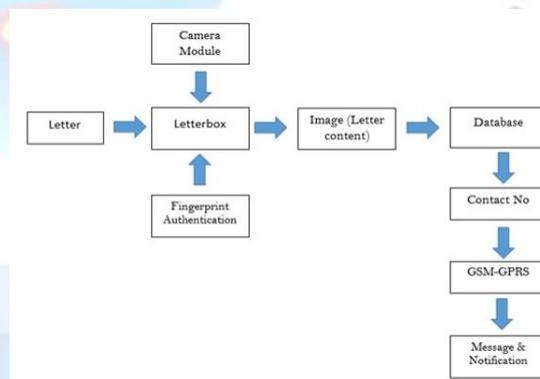


Fig 7: Proposed System

In the view of 'Smart City' we are developing advanced automated digital letterbox. Which will help to automate the conventional letterbox system the automated smart letterbox will be developed for receiver who will receive letter arrival notification on android application and through text message using GSM and GPRS module. Using this system individual client will get its own letter. Our system will be used in Flat system, bungalow. User will able to read front page of letter on mobile. Using NFC tag only authorized person can drop letter. After posting letter in the letterbox postman will get acknowledgement receipt. Using Fingerprint sensor only authorized person will get its own

letter. Using fingerprint authentication letterbox system will be more secured. This system will benefit to society, system will be- more advanced, more convenient to use, efficient, high secured, easy to use and it will reduce human efforts.

### III. Existing Project Implementation and Testing:

Android Studio 3.1 software was used to develop this system application. The system application used Java programming language. Arduino Software IDE 1.8.5 was used to develop an alarm system and also to programme Arduino Uno with the ESP8266 NodeMcu Wi-Fi module and other components. The application homepage was a startup to the application developed. On this page, users did not have to press any button to proceed to the next page. The sensor app page is a page used by users for connecting the Wi-Fi modules and turning off the alarms. On this page, there were three modules used, which were Wi-Fi connection (Enable Wi-Fi), Turn off Wi-Fi (Disable Wi-Fi), and turn off the alarm (Turn Off). Figure shows the main page as well as the site where the sensor application developed.

The tracking system was the hardware used to track movement and send data to the application. This sensor system uses sophisticated technology such as Arduino Uno R3 ATmega, ESP8266 NodeMcu V3 Wi-Fi module, PIR sensor system, alarm and LED.

### IV] Conclusion

We are developing a "Automated Digital Letterbox System" which will overcome the problems of conventional letterbox system. Using this system user will be able to read letter on the mobile, user will get notification of letter arrival. This automated letterbox will have fingerprint authentication security so that only authorised user can open and close it. Our system will be contribute in "Digital Era" projects under "Smart City". This system will be more efficient and user friendly than conventional system.

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