OORJA
ISSN - 0974-7869 (Print)
ISSN - 2395-6771 (Online)

INTERNET OF THINGS APPLICATION TO CREATE AN EMERGENCY PANIC BUTTON SYSTEM FOR ENHANCING PERSONAL SECURITY

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Abstract

In the present scenario, due to the increased cases of crime all over the world, security and its related technologies need to be constantly updated in order to allow people to take care of themselves and protect themselves from dangerous situations This paper aims to successfully propose a technique for increasing personal security by making use of a very affordable and reliable emergency push button system. This system will notify the loved ones of the owners (in any part of the world) whenever the user is in trouble and presses the button. This proposed system is extremely cost effective and reliable thus making it within the reach of every household. Whenever the user detects a threat, he/she can press the button and the system will send an email and SMS notification to the loved ones of the user. The components used to build this system are extremely sturdy, portable, easily available and affordable particularly when implemented commercially.

Keywords: Security, Cost, Internet of things, Digital Push Button

Introduction

Crimes such as harassment, abduction etc. are constantly on the rise. To be safe from such situations it is essential that individuals protect themselves by keeping safety devices and staying alert. An emergency button system such as the one proposed in this paper could notify the loved ones of the user as soon as the button is pressed by the user, thus preventing such crimes from happening by calling the necessary help immediately.

Although works related to location tracking etc. have been reported before, this paper particularly aims at creating a miniature system that would notify the loved ones of the user whether they are in any part of the world, that too at a very affordable cost.

This system makes use of the ESP-8266 WiFi enabled module with the latest NodeMCU firmware installed on it. It also uses the IFTTT (If This Then That) technology which is upcoming and ever expanding. The coding language used here is .lua. The fundamental concept used is The Internet of Things i.e. IoT.

A work proposed by Blase Ur et al on IFTTT titled 'Trigger-Action Programming in the Wild: An Analysis of 200,000 IFTTT Recipes' introduces the reader to the IFTTT service and lays down and explains the trigger-action programming technique used in it.

The Internet of Things (IoT) is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction.

The IFTTT (If This Then That) is a freely available web-based service that can be used by people to create applets. These are chains of simple conditional statements. Changes occurring in web services like Facebook, Gmail, or Pinterest initiate a trigger for the applet [For instance, an applet

may send an SMS when a particular web URL is accessed.]

The system proposed would make use of the following components:

1. ESP8266 Development Board
2. A digital emergency button
3. ESPlorer IDE
4. Use of the lua language
5. IFTTT (trigger event and applet)
6. Amazon Alexa

In the proposed system, the digital button would be connected to the ESP8266 development board. The ESP8266 Board would access the IFTTT trigger event on the pressing of the button. This would generate an email that would be sent onto the recipient's email address with the time and other details of the pressing of the button. Further, if the notification is not checked an urgent message would be delivered by the Alexa or a Google home device connected to the recipient's email alarming the listener.

Constraints

Internet connectivity is required whenever the button is pushed to notify the loved ones of the user. However, in certain remote areas, internet connectivity may not be available. If this happens, then, even if the user presses the button the email notification will not be received by the recipient. However, as soon as Internet is connected again the pending email notification will be sent to the recipient. But such delays during emergencies will make the system useless, as the purpose of the emergency panic button is not served. Another instance of this is the requirement of wireless fidelity network across the rural areas. However, soon free wi-fi services would be enabled across the globe, so this issue might not be a barrier to the safety of people later on.

Another constraint is that the miniature push button system needs to be carried everywhere by the user just like a mobile phone. Although, it is extremely small, handy, and easy to carry, yet, forgetting to carry it during an outing would render it useless.

Proposed Work

The main contribution of this work is to propose a system to alert the user's relatives and family members as soon as the user presses the button. This system makes use of the ESP-8266 WiFi enabled module with the latest Node MCU firmware installed on it along with a digital push button. The programming language used is lua. The fundamental concept used is The Internet of Things i.e. IoT and IFTTT (If This Then That). The project will be completed within a period of 2 to 3 months which includes collecting all the required materials, formulating the code, creating the digital button circuit, and tranferring the code onto the ESP8266 chip.

The project is making use of a Wi-Fi enabled chip (ESP8266), hence it is essential to have Wi-Fi or Mobile hotspot or any other form of internet connection at all times for the system to keep funtioning.

The system requires a very low budget. The entire system can be successfully completed within a budget of approximately $100-150 which includes purchasing all the components, downloading the firmwares, and programming the chip. If contructed without the Amazon Alexa, the project can be

made within a budget of $70-$100.

System Components

1. **Microcontroller:** The ESP8266 NodeMCU Wi-Fi Development board: This chip was produced by Chinese Manufacturer- Espressif. It is a very low cost WiFi chip with full TCP/IP stack and microcontroller capabilities. Buttons and sensors can be integrated with this chip with utmost ease. The ESP8266 chip has minimal external components and is extremely small in size. It is hence very suitable for our emergency button system.
2. **NodeMCU Firmware:** The NodeMCU firmware is an open source IoT platform. This firmware supports the lua language which shall be used in programming our system. The code will be transferred successfully to the ESP8266 chip only after this firmware has been successfully flashed onto the chip.
3. **IFTTT** is a web-based free service that is used by people to create small applets that allow the user to link various web services such as gmail, facebook etc. depending on the needs of the various users.
4. **ESPlorer IDE:** ESPlorer is an Integrated Development Environment (IDE) that is used by developers working with the NodeMCU firmware. It allows the developers to write code in the lua language and transfer it onto the ESP8266 chip.
5. **Device - PC/Tablet/Smartphone:** This could be any device capable of making use of the internet. The cloud services will allow to send messages and data those whose information was feeded by the user. With IFTTT maximum of five users can receive the messages.
6. **Digital Push Button:** The digital push button is readily available online on websites such as Ebay, Amazon, etc. It can be easily integrated with the Arduino or ESP8266 chip to achieve the required results.

Proposed Method

In this section, a detailed explanation of the step-by-step procedure from building the circuit to getting the mobile application up and running shall be provided.

1. The connections are made and the circuit consisting of the Push Button is set up.
2. Next, the latest NodeMCU firmware is flashed onto the ESP8266 NodeMCU Development board via the NodeMCU flasher application.
3. The Digital Push Button circuit is created.

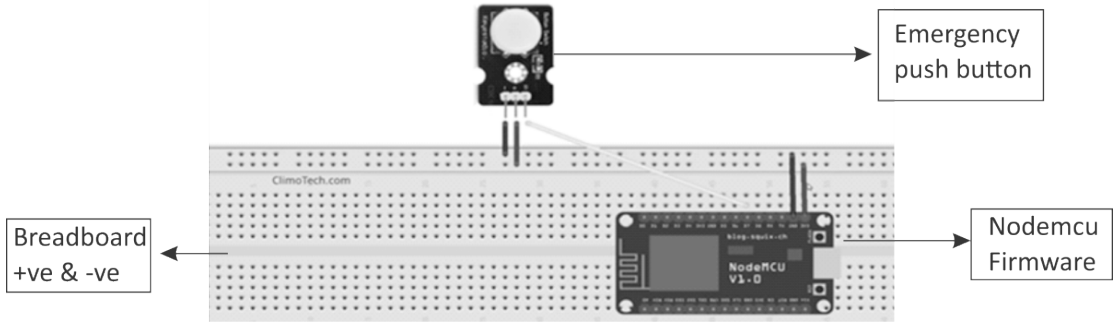

Figure 1:The Circuit Showing Connections

(Yellow wire: Data pin; Black wire: Ground; Red Wire: GPIO)

4 Next, the program code is written in lua language and is sent onto the ESP8266 NodeMCU development board via the ESPlorer IDE.

5 IFTTT web service is used to create an applet that links the push button circuit to the emails of the loved ones of the user. An appropriate trigger is chosen for instance : Say a simple phrase from the available triggers offered by IFTTT services. Now to trigger an event we specify the message Emergency Button Pressed which is later used in the code to link it with the IFTTT service. This is a unique key and is required to be tested. **(Refer Figure 1,2,3,4)**

Figure 2 : Choose the Appropriate Trigger.

Figure 3: Putting Necessary Values i.e: “Emergency”, Hurry” and “Call Cops”.

6 The email recipients also has the option of connecting Amazon Alexa or Google home device to their email services. So that, when an email notification is received, it is read out by the Alexa or Google Home device. However this step does not affect the overall system circuit in any manner

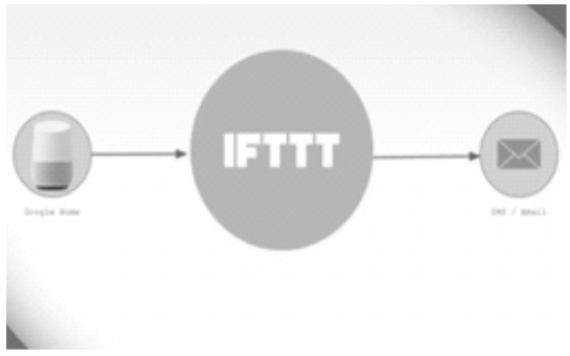

Figure 4: Chart Showing Google Home SMS/Email and IFTTT Connection

Project Analysis and Feasibility

The proposed project is feasible due to the following advantages:

- It is extremely easy to make and thus requires a minimal budget to be created successfully.
- The system would be extremely sturdy and accurate (with an accuracy of nearly 99%).
- The created system is very small and easy to carry.

Nowadays, Wi-Fi and internet connectivity are readily available in almost every part of the world. Hence, the system would be useful everywhere the person goes. Moreover, due to the advancement in technology, internet services will soon be available in even the most remote areas of the world. Hence in the future, this system would be even more viable

Observations

It was observed, that whenever the Digital Push Button was pressed, an email notification was successfully received by the loved ones of the user. Moreover, the user can edit the applet commands to receive customised messages such as “Help me!”, “I am in danger” etc. in the email.

The following readings were observed on the ESPlorer IDE as soon as the Push button was pressed:

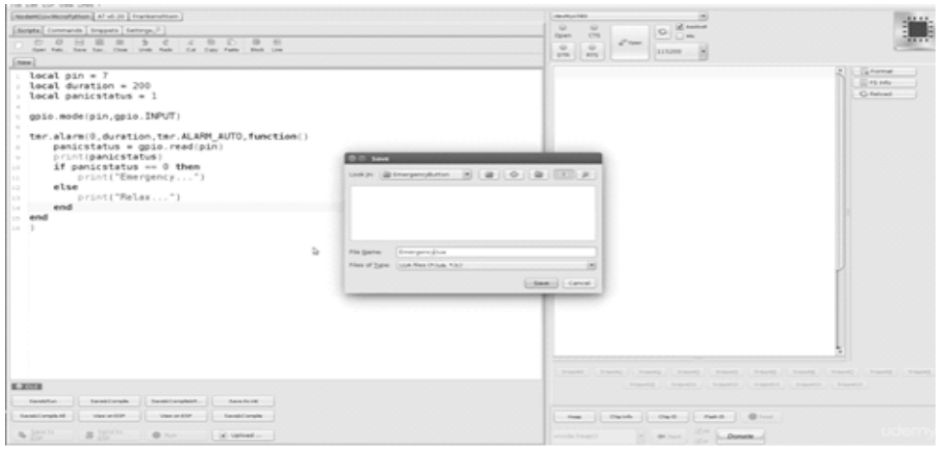

Figure 5: Code

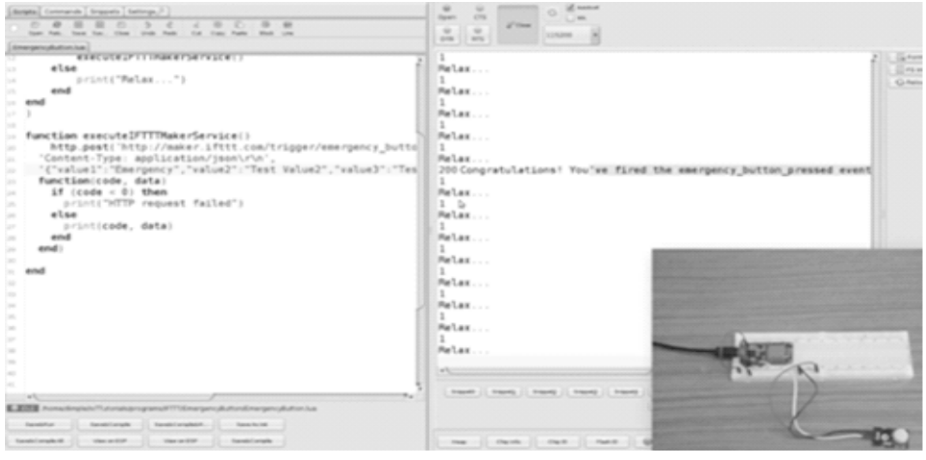

Figure 6: Transferring the Code to the Chip and Pressing the Push Button.

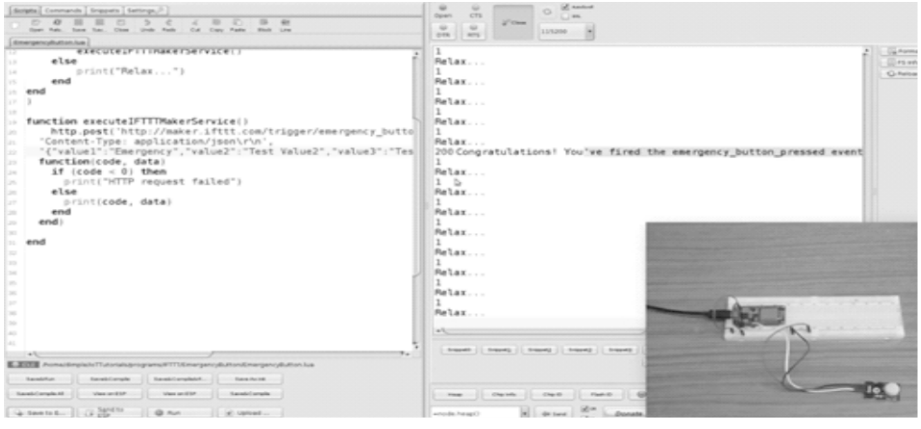

Figure 7: Copy Pasting the Values from Maker Service

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ISSN - 0974-7869 (Print)
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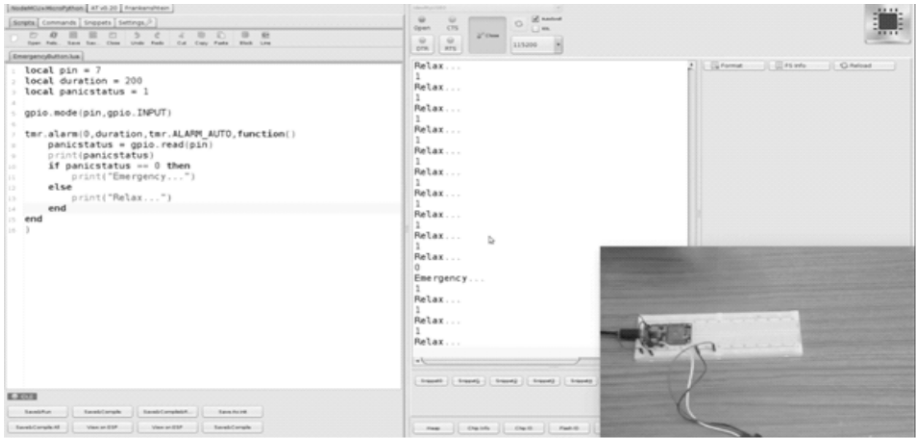

Figure 8: The Chip Displaying Emergency Message

Ultimately, the mail is delivered to the recepients by the person by pressing the button. Stating the message

Figure 9: Inbox of Mail Displaying the Mail with the Emergency Message.
(The image has been blurred to protect the privacy of the author)

Here, whenever the push button is pressed, the message 'You've fired the emergency_button_ pressed event' is published (as per our lua code). **(Refer Table 1)**

Table1 : Result Before and After the Button was Pressed

Message on ESP8266 (before pressing the button)	Message of ESPlorer IDE (before pressing the button)	Message on ESP8266 (after pressing the button)	Message on ESPlorer IDE (after pressing the button)
1	Relax1….	1	Relax1….
1	Relax1….	1	Relax1….
1	Relax1….	0	Emergency 0 (after 200ms)
1	Relax1….	1	Relax1….
1	Relax1….	1	Relax1….
1	Relax1….	1	Relax1….
1	Relax1….	1	Relax1….

Literature Review

A few similar works have been proposed earlier by various authors that make use of push buttons, or IFTTT etc. For instance, a work relating to the field of IFTTT includes 'Trigger-Action Programming in the Wild: An Analysis of 200,000 IFTTT Recipes' by Blase Ur et al (https://www.blaseur.com/papers/chi16-ifttt.pdf). This paper introduces the reader to the IFTTT web service and explains the trigger-action programming technique used in it. It explains the entire methodology of how IFTTT works, in detail, by explaining each and every term associated with it. This includes Trigger Channel, Trigger, Action Channel, Action, ID, Adoptions, Date, Description. This work analysis a data set of 224,590 recipes that are created by 106,452 authors using IFTTT. The work also analysis the explosion of channels and connections by showing that the number of new channels being added, new recipes being written, and distinct users writing recipes each month have increased over time. The paper also went on to conclude that supporting everyday uses in the IoT still remains a challenge. In the real world, a recipe can fail to complete for reasons ranging from network failures to a device being unplugged, raising questions about handling failures. Furthermore, debugging IFTTT recipes is difficult or impossible, yet obvious solutions would raise privacy concerns.

Another work proposed by Nivedita Majumdar et al titled 'Emergency Panic Button using Microcontrollers' (N. Majumdar, et al, 2014) aims at creating an emergency panic button using an Arduino Uno Board and GSM module, and a push button that can send SMS notifications to the user's loved ones in case of emergencies. In this case, the GSM module is present with a SIM card, and is hence getting the required Internet connectivity via the service provider of the SIM. This work was published in International Journal of Computer Applications Volume 99. However, contrary to the system proposed in this work, which makes use of the ESP8266 chip, this system uses the Arduino module. In this work, a signal is sent to the GSM Module through the Arduino Board. This in turn will send an emergency message to the user's contact. This contact must be pre-defined in the system and will be sent the exact GPS co-ordinates of the position of the user via the text message. This information can be utilised by the emergency contact to pin-point the user's exact location on Google Maps and thus track the user as early as possible.

Another work titled 'Near Real-Time Tracking of IoT Device Users' by Jinseong Kim et al (J. Kim, J. Jang and I. Jung, 2016) proposes a simple tracking scheme of Internet of Things (IoT) devices. On the basis of timed snapshots of IoT devices, this work attempts to track the movements and locations of the devices' owners indirectly and efficiently. To reduce the overhead incurred by real-time tracking of the (mobile) IoT devices, this proposed scheme by Jinseong Kim et al adopts quasi-real-time

tracking utilizing the LIDx protocol and its period, and collects only a small amount of information in each snapshot, such as, time, remaining energy in the mobile device, and the type of wireless communications interface. In this scenario the users are traced without authentication. Hence, their privacy is protected, since their identities and the locations associated with their identities are concealed. The author claims that this proposed simple location tracking is expected to be helpful in rescuing the persons in danger because of disasters or accidents in basements or closed spaces such as ships, which are areas outside of the range of GPS or with weak and unstable public communication signals.

Conclusion

This paper successfully gives a technique for aiding the security of every household by creating a reliable EMERGENCY PUSH BUTTON system that protects every individual from burglaries, thefts, or any unauthorized invasion that might cause threat. The concept of Internet Of Things (IoT) and IFTTT services are the key aspects of this system. The accuracy of the proposed system is almost 99 percent and it is extremely reliable yet affordable. This system is very sturdy and reliable, and can act as a huge boon to the security industry if implemented commercially.

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