Smart Frame - A Location Sensing Picture Frame using IOT

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Abstract—To make communication easier, We have created a IOT Location Sensing Picture Frame. A decorative item which acts smart to tell the user the location of their family member. Each family member has a photo of themselves in the picture frame. Each photo has a corresponding strip of lights that is controlled by an app which runs in the background of the designated family member's smart phone. The lights are programmed to display colors in a spectrum ranging from red to green. Even the app is designed in such a way that a panic alert can be sent to the emergency contact and alert will be depicted in the photo frame with red lights and a buzzer.

Keywords-*Smart Frame, Location Sensing, Internet of things, Nodemcu Wi-fi Module, ThingSpeak, Android App Development.*

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I. INTRODUCTION

This paper presents a helpful user friendly location sensing frame with an application that runs in the background capturing the location of the person with the help of a smart phone. The application "Smart Frame" needs to be installed in the smart phone of the person in order to track the location of the person using location sensor and GPS. All the details of the person like photo frame number in the device, emergency contact and locations can be set using the app. The device acts dynamically it can be connected to the router. The introduced method uses a cloud platform to store the location co-ordinates of the person and send the color code as input to the picture frame which depicts varies lights depending upon the location of the person.

Another useful feature of this picture frame is its ability to communicate when family members have arrived at specific locations that can be updated on their phones. Let's say you are going out of station and arriving at a specific bus or train station, you can set that location on your smart phone as far in advance as you like, and the picture frame will change the color of your lights to blue when you arrive.

II. RELATED WORK

A. *Sensing Human Activity :GPS Tracking in Netherlands*

The enhancement of GPS technology enables the use of GPS devices not only as navigation and orientation tools, but also as instruments used to capture travelled routes: as sensors that measure activity on a city scale or the regional scale. TU Delft developed a process and database architecture for collecting data on pedestrian movement in three European city centers, Norwich, Rouen and Koblenz, and in another experiment for collecting activity data of 13 families in Almere (The Netherlands) for one week. The question posed is: what is the value of GPS as 'sensor technology' measuring activities of people? The conclusion is that GPS offers a widely useable instrument to collect invaluable spatial-temporal data on different scales and in different settings adding new layers of knowledge to urban studies, but the use of GPS-technology and deployment of GPS-devices still offers significant challenges for future research [1, 2, and 9].

B. *Wireless LAN Location Sensing for Security Applications in Houston, Texas*

They considered the problem of using wireless LAN location sensing for security applications. Bayesian methods have been successfully used to determine location from wireless LAN signals, but such methods have the drawback that a model must first be built from training data. The introduction of model error can drastically reduce the robustness of the location estimates and such errors can be actively induced by malicious user's intent on hiding their location. They provided a technique for increasing robustness in the face of model error and experimentally validate this technique by testing against hardware, modulation of power levels, and the placement of devices outside the trained workspace. Their results have interesting ramifications for location privacy in wireless networks [3, 10].

C. *TrackMe – location tracking system in Trivandrum,India*

Tracking of locations of a mobile object or person continuously using smart phones using conventional Global Positioning System (GPS) puts a huge toll on the battery life of power-limited smart phones. The power consumption of a GPS unit is much more than any other sensors in a smart phone. Worse, the GPS unit cannot be switched off even if the smart phone is in sleep mode. GPS, in addition, is not effective in

indoor locations because suitable number of satellites cannot be obtained for acceptable communication. So they proposed a low power and low cost fast location tracking system for a smart phone device which continuously tracks the locations of a moving device with accuracy. The inbuilt sensors of a smart phone like the accelerometer, the magnetometer and the gyroscope have been utilized, instead of the costly GPS unit, to track the continuous locations of a mobile device [4, 7, and 8].

III. SMART FRAME – LOCATON SENSING PICTURE FRAME

Mostly people are worried about the safety of their family members who goes to distant places on daily bases to perform their jobs or to attend their college sessions. The family members at home have no clear idea if the person has reached their destination or not until they call them up and enquiry. Sometimes it would not be possible for the person to inform the family due to work busy. Family members are worried of the person's safety. To encounter this problem, we came up with an idea of this location sensing picture frame. Without disturbing the privacy of the person, this frame helps in providing the location of the person with the help of led lights. In order to provide security, a panic alert option is provided in the app which helps in sending a danger alert with location of the person to the emergency contact and an alert to the frame in home. We also surveyed many people from different sectors to understand the effectiveness of the problem.

TABLE I. SURVEY.

Name	Profession	Do you face this problem?	Review
Mr. Suman	Software Engineer	Yes	Sometimes, due to the traffic. It's tough to pick calls and tell mother about my delay.
Ms. Shobha	Home maker	Yes	It is a useful decorative item
Ms. Naveena	Btech student	Yes	It would be helpful for my parents to knew about my location

IV. ARCHITHECTURE OF SMART FRAME

Generally, our product is operated using a Nodemcu Wi-Fi module which is embedded with the photo frame. The Led Lights are connected to the nodemcu board. The board is programmed in such a way that it receives the command from the ThingSpeak cloud platform and performs the operation in order to depict the light in the Led strip. The cloud is updated with the location of the person and the command from the smart phone.

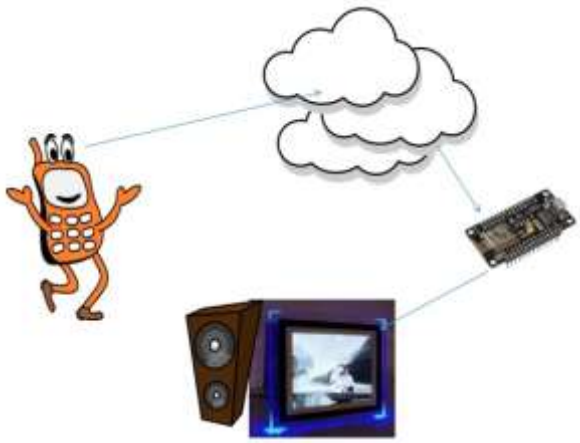

Figure 1. Architecture of smart frame.

A. ESP8266 NODEMCU :

An open source filmware and development kit that helps you to prototype IOT product. Features are open-source, interactive, programmable, low cost, simple, smart, WI-FI enabled. Advanced API for hardware IO, which can dramatically reduce the redundant work for configuring and manipulating hardware. Code like Arduino but interactively in Lua script. Event-driven API for network applications, which facilitates developers writing code running on a 5mm*5mm, sized MCU in Nodejs style. Greatly speed up your IOT application developing process. Less than $2 WI-FI MCU ESP8266 integrated and easy to prototyping development kit. We provide the best platform for IOT application development at the lowest cost. The Development Kit based on ESP8266, integrates GPIO, PWM, IIC, 1-Wire and ADC all in one board. Power your development in the fastest way combining with NodeMcu Firmware.

The Wi-Fi module setup code along with the LED lights and buzzer code is entered in the board. The Wi-Fi module up on receiving the commands from the cloud, the code runs and the respective led strip is set on to the corresponding color command [5] .

B. WS2801 LED Strip :

This is some of the highest quality WS2801 LED lighting available. Constructed on an extremely high quality white flexible PCB, these strips contain 32 WS2801 ICs and 32 high quality SMD5050 RGB LEDs per meter. These LED strips speak a SPI protocol, and can easily be driven by Arduino, PIC, and ARM microcontrollers!

- The basic specs for these strips are:
- 32 SMD5050 RGB LEDs per meter, with 32 WS2801 ICs (each LED is individually addressable).
- IP67 waterproof, with a silicon jacket around the strip.
- 5V operation.
- Strips can be cut every LED (1 IC, 1 LED per segment)
- White PCB.
- These strips take data in the standard red, green, blue order [6].

C. Arduino IDE :

The Arduino Integrated Development Environment - or Arduino Software (IDE) - contains a text editor for writing code, a message area, a text console, a toolbar with buttons for common functions and a series of menus. It connects to the Arduino and Genuino hardware to upload programs and communicate with them

The Arduino Software (IDE) uses the concept of a sketchbook: a standard place to store programs (or sketches). The sketches in the sketchbook can be opened from the File> Sketchbook menu or from the Open button on the toolbar. The first time run the Arduino software, it will automatically create a directory for sketchbook. We can view or change the location of the sketchbook location from with the Preferences dialog.

It allows us to manage sketches with more than one file (each of which appears in its own tab). These can be normal Arduino code files (no visible extension), C files (.c extension), C++ files (.cpp), or header files (.h).

The code is uploaded into nodemcu board with the help of this Arduino ide, setting the appropriate values to board, CPU frequency, Flash size, upload speed and port [11].

D. ThingSpeak Cloud :

ThingSpeak is an IOT analytics platform service that allows us to aggregate, visualize and analyze live data streams in the cloud. ThingSpeak provides instant visualizations of data posted by our devices to ThingSpeak. With the ability to execute MATLAB® code in ThingSpeak we can perform online analysis and processing of the data as it comes in.

Some of the key capabilities of ThingSpeak include the ability to:

Easily configure devices to send data to ThingSpeak using popular IOT protocols.

- Visualize your sensor data in real-time.
- Aggregate data on-demand from third-party sources.
- Use the power of MATLAB to make sense of your IOT data.
- Run your IOT analytics automatically based on schedules or events.
- Prototype and build IOT systems without setting up servers or developing web software.
- Automatically act on your data and communicate using third-party services like Twilio® or Twitter®.

ThingSpeak cloud is used to store all the details of the user like location, emergency contact and frame number. It provides API keys to upload and retrieve the values from the cloud. As a single photo frame may contain 2 or more pictures of family members, each person has a separate channel in the cloud.

Talkback is another service provided by the ThingSpeak platform. It helps in receiving and forwarding the commands from the smart phone to the nodemcu. All the commands that are sent from the smart phone by calculating are saved in the talkback and forwarded to the smart frame [12].

E. Thunkable Android App Builder :

Thunkable is a drag and drop platform for building native and mobile apps. We can design our Beautiful App with native user interface components that feature Material Design elements-- and even add our own custom Fonts (.ttfs). We can also capture or select from our favorite images with the Camera and ImagePicker components and we can also automatically add emotions and captions to them with the use the Microsoft Emotion and Image Recognizer. We can add Sharing to our apps or build our own Messaging App adding fun services like Google Voice Recognizer and Text-to-Speech, and Yandex Translate. We can invent a robust Mapping App for our business or community powered by our Google Maps and Location Sensor components. It allows storing things locally and on the cloud with Tiny DB, Firebase DB, Cloudinary DB and more.

It provides an inbuilt map interface as a component in the services. It makes the developing of application easier by providing a way to write the algorithm to calculate the distance of the person from his destination [13].

V. PROPOSED ALGORITHM

Initialize the device by connecting it to the 5v power supply. The Wi-Fi module needs to be connected to the router, all the LED lights in the frame turns to light color indicating the activation of device.

- START the device.
- Connect to the Wi-Fi router.
- Enter the “frame number” and “emergency contact” in the application.
- Set home location and work location.
- When you are in danger click ‘PANIC’ button.
- If you are busy then touch ‘BUSY’ button.
- If you are on a vacation, set the starting point and destination using “On a Vacation!” button.
- STOP

Depending on the location of the person, the distance of the person is calculated and a color code is sent to the device via

cloud. Up on receiving the color code from the cloud, device depicts the color in the frame accordingly.

VI. RESULTS AND DISCUSSION

The proposed system device is more user friendly. It uses the variation of lights to show the nearness of the person in the frame. Replacing the Intel Edison board with nodemcu reduces the cost of the product and makes it cheaper.

Figure 2.Chart showing the updation of home location in cloud.

The figure 2, shows how the latitude and longitude co-ordinates of the location are stored in the cloud. Each person has a home location, work location, source location, destination location and emergency contact fields in the cloud which can be monitored. They are used in calculating the person's distance from the respective locations by tracking the location of the person using location sensor through app in the smartphone.

Figure 3. Screenshots showing Functional requirements like emergency contact, lcoation to be set by the person.

The figure 3, shows few screenshots of the application. It asks for the frame number, emergency contact to save in the cloud. The locations required are set by using a marker in the map.

If the person is in any danger situation, he can intimate it by shaking the phone thrice or by clicking panic button. On clicking the button, an alert will be sent to the emergency contact and all the LED lights in his/her frame will be turned to red and a buzzer sound is made indicating that the person is in danger.

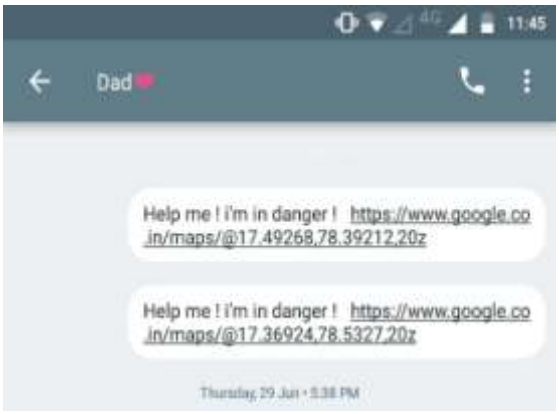

Figure 4. Screenshot of the alert message sent to the emergency contact

The figure 4, shows the screenshot of the alert message sent to the emergency contact. The message consists of text asking for help and the exact location of the person, so that the person can be tracked easily.

VII. CONCLUSION AND FUTURE WORK

This proposed work is successfully designed, implemented and tested. Our product helps in knowing the location of the person without disturbing the privacy of the person and without contacting through a call. As the variation in lights can be seen by naked eye and a minimum knowledge about in identifying the lights is enough to make use of this device. This simplicity of the product makes it user friendly and even making the uneducated people easily access the device. This system has high practical value and cost efficient. This work is having a wide scope. A mobile application which can be further modified using good graphical interface and a function to send voice commands to the device as a message. Embedding a led screen with the device helps to make it display updated pictures of the person with his permission. In case of panic alert, the exact location of the person can also be shown in the frame along with the map.

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