Human Tracking System Based on GPS and IOT (Internet of Things)

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Abstract. Human safety is an important issue due to the sudden rise of crimes and accidents. To resolve this issue we propose a Human Tracking System based on GPS (Global Position System) and Internet of Things (IOT) that has dual security features. The proposed system incorporates the available technical know how in sensors (GPS,gravity etc.) to track, monitor and assist a person in different situations [3, 11]. The proposed system may be utilized by children in crowded areas and by anyone who wants to get assistance at the time of distress like patients. Our proposed concept of developing such a device is to create an environment where anyone can be located at any time thus reducing the cost and efforts involved to track them by several agencies. The system will alert the right agencies if a person, like a child or a patient, is in need of assistance.

Keywords: Arduino UNO · Ultimate Adafruit GPS (Global Positioning System) shield · ESP2866 WiFi module · Arduino IDE software · Thing speck cloud server and fritzing software (design circuit diagram)

1 Introduction

Why is it time to take the Internet of Things (IOT) seriously? "The Internet of Things will be five to ten times more impactful in the next decade than the entire internet has been to date" [1] and [2]. So we can define IOT is an internetwork of physical objects embedded with sensors, computers, connectivity and actuator that enables these objects to acquire data, transform it into knowledge, make intelligent decision and generate physical actions to manipulate the environment. This project is based on IOT that works for tracking the human location. We know that today our family/human security has become very important because day by day crime rate is increasing [7]. The proposed device not only identifies or tracks the location but also achieves a complete manufacturing cost of device less than that of any other tracking devices. So any one easily can afford our device and can track our children or any patient (who is not mentally or physically fit). Further literature on IOT can be found in [10–12].

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2 System Deployment

2.1 Hardware Component

Our Human Tracking Device is basically tracking the location through GPS Tracker. So our main goal is to read GPS data and send it to the cloud. After that the cloud sends the stored data defining the location through mobile or any other application devices. We are using the following hardware components for making the complete Human tracking device shown in Fig. 1.

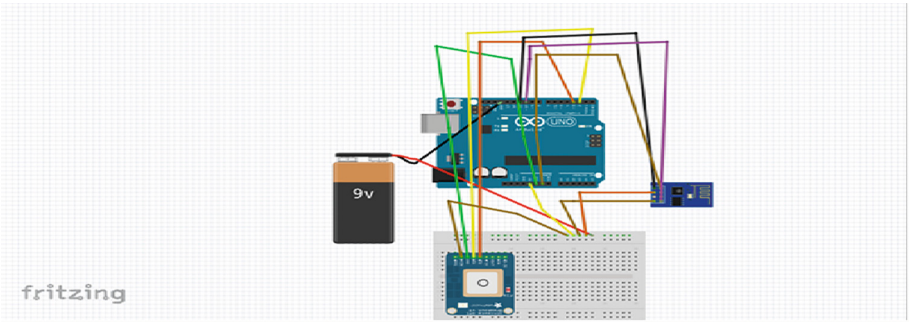

Fig. 1. Hardware component of IOT tools

A. Arduino UNO (Micro controller)
B. Adafruit Ultimate GPS Breakout
C. ESP2866 WiFi
D. Battery

A. Arduino UNO (Micro controller): In Human Tracking Device we are focusing the cost effective product so that we are using Arduino UNO which is also known as tiny computer that we can connect to electrical circuits. This makes it easy to read data from outside and control output and send a command to outside. In this project we are connecting Arduino UNO to Adafruit Ultimate GPS Breakout, ESP2866 WiFi and battery(9 V). The following Tables 1 and 2 showing the Pin connection between devices in Fig. 2.

B. Adafruit Ultimate GPS Breakout: Adafruit Ultimate GPS shield not only reads the Global Positioning System latitude and longitude Data but also is small and portable. This is an excellent GPS being affordable, easy to use, and capable to connect 22 satellites. Table 1 page no 4 shows connection between Arduino Uno.

C. ESP2866 Wi-Fi: It is a low cost WiFi microcontroller and it is used for home automation. Now when we read the GPS Data through Adafruit Ultimate GPS Shield then we have to store and retransmit the data to Cloud (Thing Speak) to client Application (cellular mobile or operating system). We need to connect the ESP2866 WiFi to the internet and to the particular device transmitting to each other shown in Fig. 3. Table 2 shows the connection.

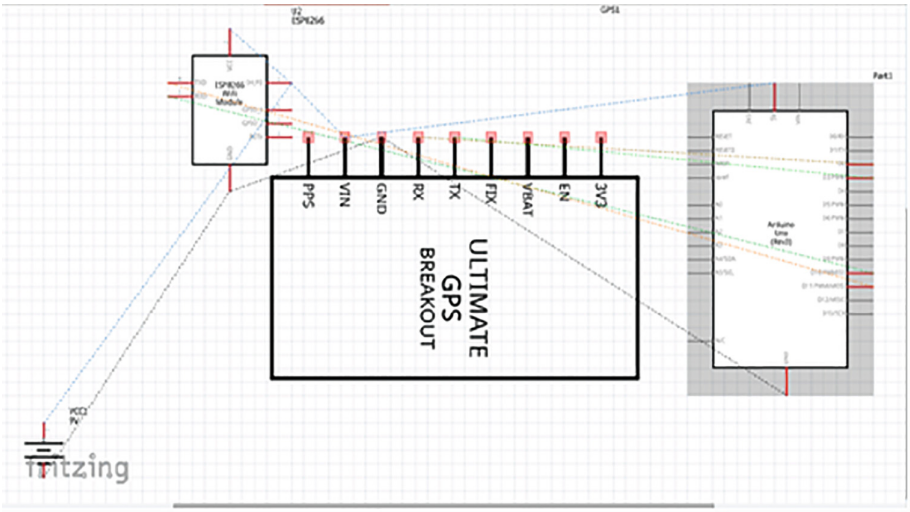

Fig. 2. Circuit diagram of our proposed device

Table 1. Connecting the Adafruit ultimate GPS unit to Arduino UNO

Connecting the Adafruit ultimate GPS unit to Arduino UNO	
GPS Pin	Arduino Pin
Vin	5 V
GND	GND
RX	Pin 2
TX	Pin 3

ESP8266 specifications

- 802.11 b/g/n protocol
- Wi-Fi Direct (P2P), soft-AP
- Integrated TCP/IP protocol stack
- Built-in low-power 32-bit CPU
- SDIO 2.0, SPI, UART

D. Battery: The proposed device requires 9v power supply.

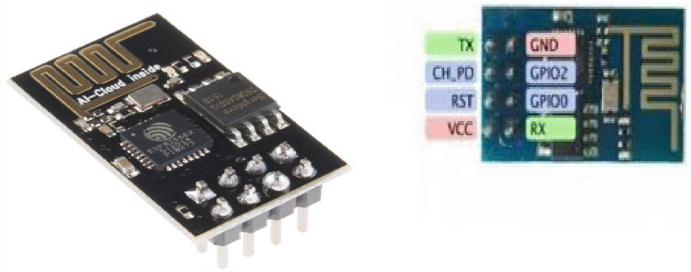

Fig. 3. ESP2866 WiFi module

Table 2. Connecting the ESP2866 WiFi module to Arduino UNO

Connecting the ESP2866 WiFi module to Arduino UNO	
ESP2866 WiFi Pin	Arduino Pin
VCC	5 V
GND	GND
CH_PD	5 V
RX	Pin 10

3 Architecture of Human Tracking System [8]

Figure 4 gives the architecture of the schematic diagram of our processed device showing Arduino Uno working as microcontroller board to connect Ultimate Adafruit GPS shield and ESP2866WiFi through jumper wire through pin modes [6]. The connection description is already given in Tables 1 and 2. This means the architecture of Human Tracking Device working principal is based on the location tracking through GPS navigated by satellites. The transmitted signals of satellite's information of latitude and longitudes reading is done by Ultimate Adafruit GPS shield. That information is retransmitted by WiFi module and stored into the cloud and the data is extracted from cloud through App or any other Application. All the component power

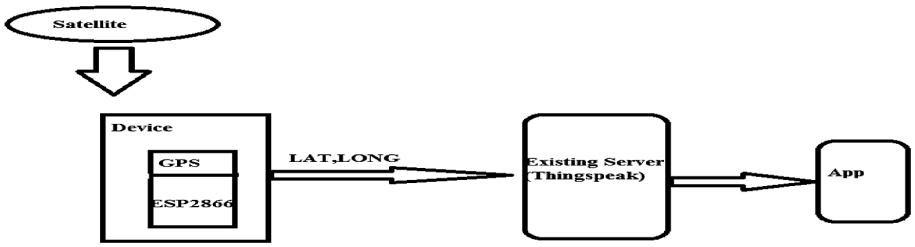

Fig. 4. Architecture of proposed device

supply is provided by DC charge 9 V battery. So the basic concept behind the making of an effecting tracking location device is low cost.

4 Working Principle of Human Tracking System [4]

Our proposed device is based on IOT (internet of things) which has a device communication interconnected with internet. We are using GPS Shield for reading the GPS values. In this device we are using the WiFi module with Arduino UNO processor and GPS Shield that is useful for home Automation/Internet of Things applications.

Our proposed device working on four phase-

(i) Client Device-Tracker Device (ii) Satellite-Data Transmitting (iii) Cloud Server (Thing Speak)- channel where we sending data and storing it. (iv) Cellular Device (Mobile, System)- App are used to show the location of client.

The following diagram (Fig. 5) shows the communication between device and internet. This is the example of working principle human tracking device.

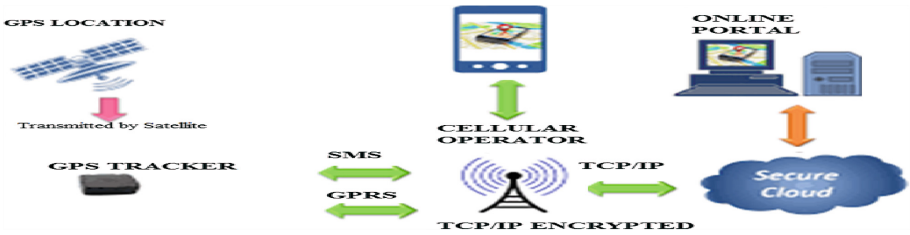

Fig. 5. Example of working principle of human tracking system

5 Software Component

Our proposed device was built using basic programming languages in C++ on Arduino IDE software. To compile Hardware in Sketch book of Arduino IDE we needed a library to install in GitHubs [5]. They are given in the following table (Table 3).

Table 3. Arduino hardware's supportive library [9]

Sl. no.	Hardware/software	Library
1.	GPS Shield (Adafruit ultimate GPS breakout)	Adafruit_GPS
2.	ESP8266 WiFi	All ESP8266_WiFI

6 Results

The Human tracking device gives the results in the following steps:-

- All the hardware components are connected by jumble wiring. After power is supplied all hardware LED lights are blinking which shows that connection is established with the satellites.
- The proposed device GPS is connected with satellite and reads the GPS data in the form of latitude and longitude.
- The transmitted GPS data is retransmitted to the existing server (like Thing Speak)
- We can access the location of any man/woman/child through the existing server through any application devices like mobile app and Google earth etc.

The Figs. 6, 7, 8, 9 depict the pictures of Testing Hardware (Figs. 6 and 9) and Software (Figs. 7 and 8).

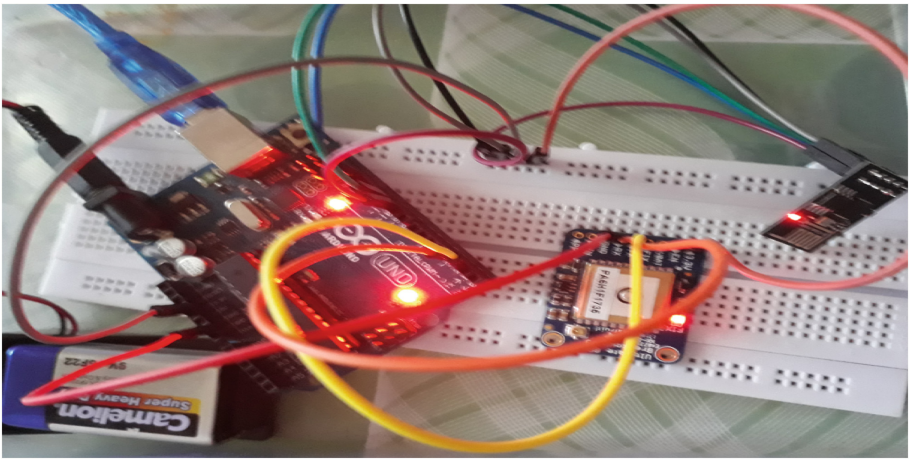

Fig. 6. Proposed device

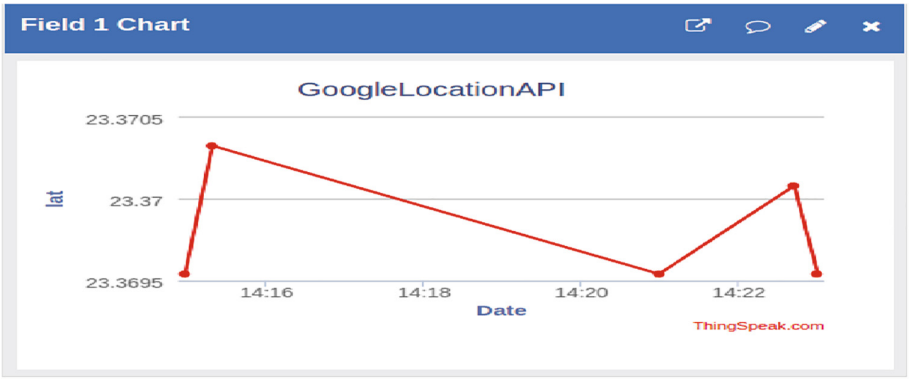

Fig. 7. Graph for latitude value of GPS in Thing Speak

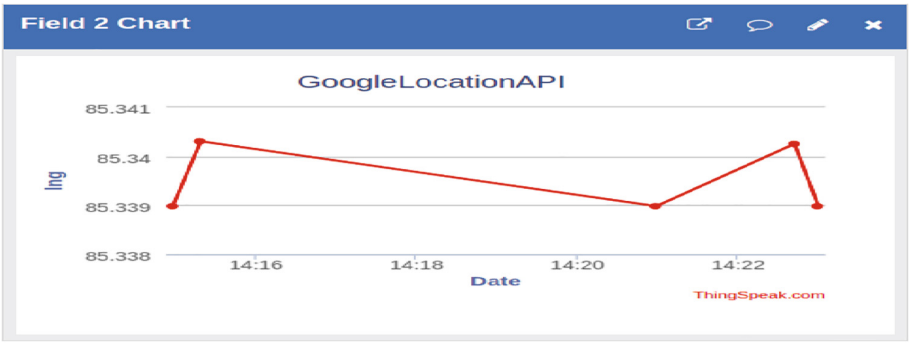

Fig. 8. Graph for longitude value of GPS in Thing Speak

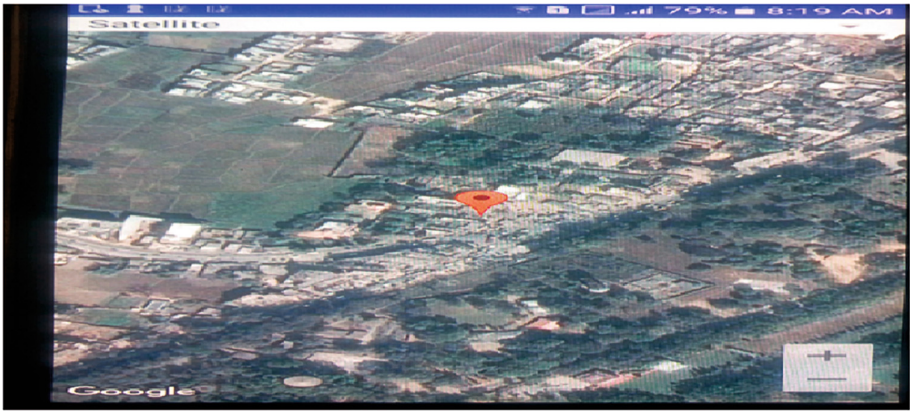

Fig. 9. Access location shown in satellite map

7 Conclusion and Future Works

Our proposed device tracks the location in low cost in a very simple way. So we can make in future smaller devices which can not only track the location with spy camera but do so in low cost also.

Compliance with Ethical Standards.

Conflict of interest All the authors hereby declare that this research did not receive any funding. They further declare that the work is new and that they do not have any conflict of interest.

Ethical Approval This article does not contain any studies with human participants or animals performed by any of the authors.

References

1. www.isro.gov.in. Accessed 4 Dec 2018
2. https://en.wikipedia.org/wiki/Internet_of_things. Accessed 4 Dec 2018
3. http://www.channelfutures.com/security. Accessed 4 Dec 2018
4. Uckelmann, D., Harrison, M., Michahelles, F.: Internet of Things, p. 353. Springer, Berlin (2011)
5. https://github.com/adafruit/Adafruit-Eagle-Library. Accessed 4 Dec 2018
6. Colon, C.R.: An efficient GPS position determination algorithm. Master of Science in Electrical Engineering thesis, Air Force Institute of Technology (1999). https://apps.dtic.mil/dtic/tr/fulltext/u2/a361729.pdf. Accessed 4 Dec 2018
7. Weber, R.H., Weber, R.: Internet of Things, Legal Perspectives, p. 135. Springer, Berlin (2010)
8. Delsing, J.: IOT Automation: Arrowhead Framework, p. 366. CRC Press, Boca Raton (2017)
9. https://learn.adafruit.com/adafruit-ultimate-gps/overview. Accessed 4 Dec 2018
10. Perera, C., Liu, C.H., Jayawardena, S.: The emerging internet of things marketplace from an industrial perspective: a survey. IEEE Trans. Emerg. Top. Comput. **3**(4), 585–598 (2015)
11. Chauhuri, A.: Internet of Things, for Things, and by Things. CRC Press, Boca Raton (2018). ISBN: 9781138710443
12. Hassan, Q., Khan, A., Madani, S.: Internet of Things: Challenges, Advances, and Applications. CRC Press, Boca Raton (2017). ISBN: 9781498778510