

Deploying IOT Principles for Development of Smart Backpack for Students

Durga Thokala¹, Nagalakshmi Appana², Gandhikota Umamahesh³

^{1,2,3} Asst. Professors ,Dept. of CSE, Pragati Engineering College(A), AP, India.

Abstract - Security implies wellbeing, just as the estimates taken to be protected or ensured. A little kid will here and there lock on to a cover or squishy toy that gives the person in question the sensation of security "One Single risk is all an assailant requires to achieve the undertaking" which is honest in part of as far as security. Because of colossal heap of books in rucksack conveying ordinarily by understudies are affecting individual's wellbeing which has drawn consideration of numerous researchers and specialists. This paper is one of such ways to deal with diminish understudy's knapsack trouble alongside giving security to them. With the assistance of most recent arising IOT innovation in this attempting to take care of understudies essential issues with no manual mediation, which by implication help numerous understudies, guardians and furthermore cops during examination of missing understudy.

Keywords: *Raspberry Pi, GPS Module, Camera Module, RFID, Telegram app, Internet of Things (IoT).*

I. INTRODUCTION

In the past few years student monitoring has become a challenging task. By implementing this smart backpack system in every school we can be able monitor each student's backpacks weight which are scheduled as per the Indian Government Laws, which indirectly reduces the students burden of carrying heavy load of books in their backpacks every day. Even in many schools it is very difficult for students to carry all the books every day, because the timetable of a class changes every day and the student cannot be able to remember the timetable and also which books has to be carried on that day to the school due to their lack of memory power.

If a student's backpack burden is not treated properly on time there arises high risk on student's health [7]. In order to reduce the burden of student as well as the parent and to improve quality of education system in India for both parents and students we have come up with a small prototype of smart backpack. Our gadget will be helpful for the parents in the way to check up their children's backpack through app embedded with the timetable.

Generally, the student never responds for anything either in terms of backpack weight or any situation which might not be safe for him/her, they sometime respond through their abnormal movements like sudden health issues, or remaining silent etc...For diagnosing such abnormal movements our prototype system which is powered by Raspberry pi includes RFID reader to scan and check books, GPS Module and a Camera Module to click picture of the surrounding along with location through telegram app with help of IOT parents

can get information continuously with no manual mediation [3].

II. LITERATURE SURVEY

After referring various articles and papers we can notice a common thing that "Over Weight" of a backpack is a problem that students can't be aroused [8]. Monitoring Students backpack while going to school or in the school highly impossible for a normal parents or doctors since they need to have continuous check of the students backpack whether they have bought all the books that are needed for the day or considering another case if sudden forgot to get his homework or essential book on that day etc in that situation the student may choose either to call parents so that they can come and give that book to them or go and collect from home such every single case has to be taken care. In many applications, data contains inherent uncertainty, by transmission IOT data with the use of internet, protecting over weight of a student's backpack can be reduced also reduces parents burden. Our prototype of smart student backpack provides security through the features embedded in it.

In order to address abnormal situations of students while going to school or home our portable gadget will help the student as well as the parent to know location of their children on time. With the help of panic button embedded in the backpack we are detecting every small movement of student's location and updating the parent with the help of Telegram app. Powering by Raspberry pi we are connecting our RFID reader to detect the books and also to check the changes in books if not according to scheduled timetable of that day. Raspberry Pi camera module can be utilized to take top notch video and stills photos [4]. Considering all aged groups we have designed this prototype. In this way, our prototype monitors not only the student's but also any backpack owner which can be used by anyone with affordable cost.

III. MOTIVATION

Security and automation is a prime aspect in everyone's life [6].The Continuous update in the technology has motivated to develop a system in field of education system. We have also observed that there is no such exact tool for monitoring the students backpack weight in schools till now which are automated. By referring various published papers, websites and analyzing health care medical science we have come up with an advanced student monitoring system where simple

small kit embedded in the backpack can enhance the changes in the student’s day-to-day life and also keeps parents updated from time to time. In the huge efforts of making our lives simpler and better we are contributing a fraction of a part through our system [1] – SMART BACKPACK [9].

As our device has small connections which are completely computerized makes it ease for the parents and students to keep a check on the books which has to be carried to the school on that particular day. It is also comfortable for the parents to use it without getting tensed about their children’s backpack weight and their safety. As said by Namita Gupta “School backpacks loaded with dreams, Searching aims hopes within” we are providing a smart way that help student’s through our device.

IV. EXISTING SYSTEM

The backpack now-a-days became an essential need for everyone not only a student but also the travelers, also the people who are going to office in order to keep their laptops, files, or any office related stuff etc.. Which are some existing cases. Through that existing approach it was not possible for a backpack owner to keep in check about the backpack items and the owner’s security itself. So, just by opening a backpack the owner can know about items in the backpack which is completely outdated in cases if the particular item is unnecessary or missing.

V. PROPOSED SYSTEM

In this we are maintaining measures of each and every problem of the student through the Telegram app. This paper is to provide security to the people and make them feel safe [2].The change while dropping a book can continuously monitored by parent’s mobile in the backpack. We are just maintaining a connection of student’s time table of like which book has to bring which has not be. Just by pressing a panic button the parent can able to get students location with a picture of surrounding along with it. Thus through this approach we are reducing burden and providing security to student.

VI. REQUIREMENTS

1. Hardware Requirements
 - Raspberry Pi
 - SD Card
 - RFID Reader and tags
 - Camera Module
 - WI-FI Module
 - GPS Module
 - ARM 11
 - Cables and Connectors
2. Software Requirements
 - Qtopia Tool
 - Raspbian OS
 - Python

VII. CIRCUIT DIAGRAM

The Smart secure student backpack pack is an IOT framework used to society. It alerts the student and parent if

the book mismatches/dropped extra by comparing with timetable of student present in database by giving alarm through buzzer and telegram app. System design is shown in the below diagram.

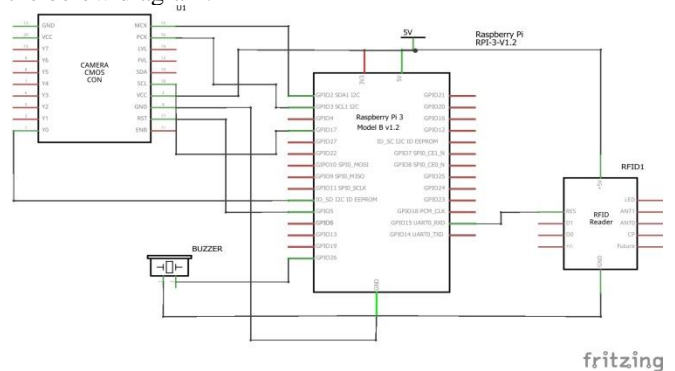


Fig 1: Circuit Diagram

VIII. HARDWARE COMPONENTS

The main aim of smart backpack for students is to reduce their backpack’s weight and provide security in order to make the idea work we have to design, examine and test the hardware we are using to make it work. Here this module describes the features of components of various units like Raspberry pi, RFID, GPS & Camera Module mainly. As per the instructions produced at the microcontroller, the proper action will be made [5]. Each and every component used for building of system – smart backpack is described neatly with the figures and descriptions as below.

I. Raspberry Pi:



Fig 2: Raspberry Pi

An Open Source ecosystem that runs based on Linux, low cost very cheap computer which is in credit-card sized called Raspberry Pi that uses Standard keyboard, Mouse and plugs into a computer monitor or TV enables us to learn and write programs from Scratch, Python. Raspberry pi1, pi2,pi3 are the three main types of it. It consists of Broadcom BCM2387 chip-set processor, along with memory card, GPU, Wireless LAN and Bluetooth embedded in it. It also consists of Ethernet, Memory slot, Audio-Video Output pins along with GPIO, Camera, Display connector pins.

2. RFID- Reader and Tags



Fig 3: RFID Reader Module

Every single functionality in backpack regarding checking of particular book is functioned through RFID reader and tags [10]. In order to understand the every single movement in the RFID reader module that is receiving of wirelessly connected objects through RFID tags. The tags are attached to the items which need to be detected by the tags chips connected with help of antenna in it. The EPC (Electronic Product Code) along with a memory is embedded in the small tag-chips. The communication is done through the reader to the tag within the specified range of 5 to 15 cm with voltage of +5v and max current of 50mA through TTL mode of transmission.

Mainly these tags are available in many types some majorly used tags are passive, semi-passive and active tags.

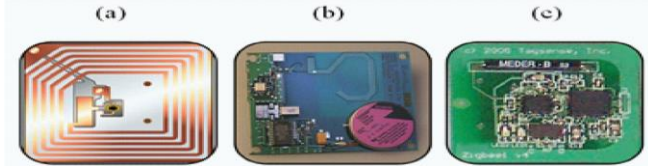


Fig 4: Types of RFID Tags

The RFID reader is treated access point as a network-connected device which sends power, data and commands to the tags so that data received from the tags can be made available to the user in order to proceed for further instructions.

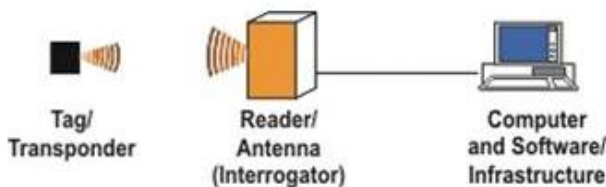


Fig 5: Working of RFID Technology

3. CAMERA MODULE:

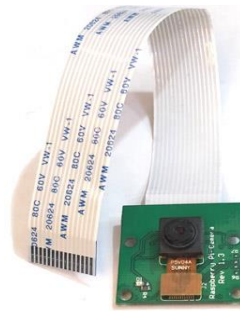


Fig 6: Pi Camera Module

A tiny pi-camera with dimensions of 25mm x 20mm x 9mm is compatible of all raspberry pi types. With the means of short ribbon cable the camera is connected to the Broadcom BCM2835 processor of Raspberry pi. The Camera is used to catch the live images of the area [2] with higher bandwidth carries pixel data to processor. It has a fixed focus lens on the board with the native resolution of 5 megapixels. With the means of this tiny camera we can take HD videos and pictures by adjusting the lens for clear clarity. This camera can also be applicable to shoot time lapse, slow motion effects on pictures and videos. The camera is backed up by the newest form of Raspbian.

4. GPS (GLOBAL POSITIONING SYSTEM)

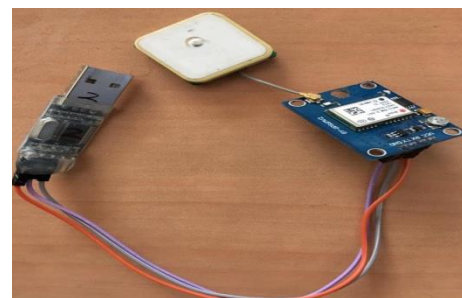


Fig 7: GPS Module

In order to detect any object location we make use of GPS mainly [8]. Generally GPS satellites are present in the sky which contains accurate atomic clocks that will continuously sends data down to earth by means of RF frequencies. In order to calculate accurate time and position of location we make use of these received different pieces of data from satellites which are then collected by GPS receivers. Our system can also be used for detection of students location. But this GPS receiver depends on many variables like obstruction due to objects (trees, buildings etc...), Weather changes, position of satellites etc.... It consists of expensive super-high frequency with power supply of 3-5v, compact size, and easy usability for long distance measurement and mapping.

5. WIFI MODULE



Fig 8: WIFI Module

In our gadget we are using a self-contained SOC unit of ESP8266 Wifi-module with standard AT Command set firmware. Providing a Wifi network connected with the microcontroller is integrated with TCP/IP protocol stack.

6. BUZZER



Fig 9: Buzzer

This is mainly used to alert the user in case of any abnormal situations by means of piezoelectric effect. By means of piezo crystals between 2 conductors produces push and pull action which in directly produces the sound of range 2 to 4kHz that can be used in alarm circuits.

IX. FIRMWARE IMPLEMENTATION

This part deals with the controlling and implementation part of modules connected to Raspberry pi.

1. Software Tool Required

- In order to program Raspberry pi we are using Raspbian OS, Qtopia software tools.
- 2. Programming Microcontroller
- In order to program the raspberry pi we have used the python language to program and compiler for reducing the complexity of code. This is suitable for execution, open source software development.
- Along with this we have also used Qtopia GUI tool in order to design background interface for developing software applications.
-

Qtopia GUI:

In order to develop application software we are using Qtopia GUI which is embedded with linux-based mobile computing devices. It is an subsidiary of Digia of Qt Software.

Qt:

It is an application framework which can be run on both software and hardware platforms in order to develop application software with little bit or no change in codebase with help of graphical user interface (GUI). It mainly uses standard C++ for simple handling of events, also for developing server applications.

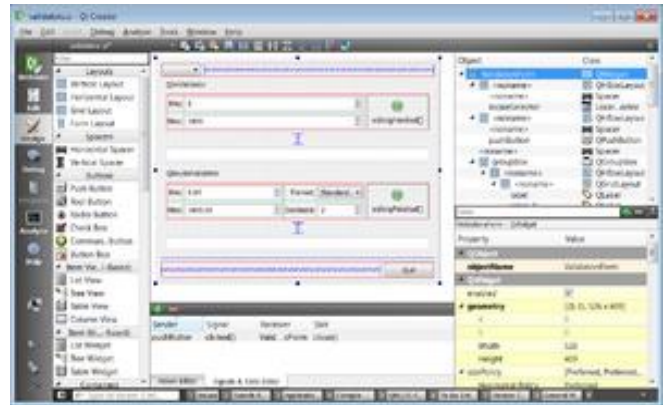


Fig 10: GUI designing in Qt

Qt is also termed as standalone tool as it is embedded with its own set of different development tools in order to provide ease for cross-platform development. Some of its tools are Qt Creator, Qt Linguistics, Qt designer, Qt Assistant etc...

Raspbian OS:

In order to utilize the utilities of Raspberry Pi and also to optimize basic set of programs in operating system we make use of Raspbian which is an free operating system that optimizes for the best performance on Raspberry pi and also more than a pure OS based on Debian.

Database:

In order to arrange the books in a backpack according to the day in timetable we make use of database. A database is nothing but the collection of homogenous and organized form of information. We are storing the student's timetable in the database so that it can be easily manageable, accessible and updatable by the students, parents as well as the class in charge of the student class.

Remote User:

In this paper the remote user is the parent because they would be notified with every set of movement in the backpack. During dropping of books they can be notified if the book is according to the schedule of that particular day or not. Not only that they can also be notified if their children is in any danger situation by means of image of surrounding with its location where their child is present.

X. ALGORITHM

Steps for describing flow of execution:

1. Turn On the gadget and interface with the portable area of interest.

2. Mean While start the RFID per user to examine the books to drop in the knapsack.
3. Place the book accurately where the RFID tag is joined so it can identify it appropriately.
4. Firstly we need to enter the day with the goal that the RFID per user can examine as per the timetable implanted in the data set.
5. Then Place book on top of the per user to filter it.
6. If the book is missing at that point go to stage 10.
7. If the book is additional at that point go to stage 10.
8. If the emergency signal is squeezed then go to stage 11.
9. Else read next book and rehash stages 6, 7 in at regular intervals.
10. Ring the ringer for ready flag and send notice in wire application likewise assuming extra-"Not According to schedule" and if missing-"A few Books are Missing" [8] at last go to stage 12.
11. In frenzy mode initiate camera and GPS module agreeing click picture of encompassing alongside its area to the message application of the parent go to stage 12.
12. Turn off the gadget tasks.

XI. WORKING PRINCIPLE

The smart secure student backpack pack for monitoring of student is done as:

1. The RFID reader connected with the Raspberry Pi and WIFI module.
2. The program is type on the Raspberry Pi.
3. The Raspberry pi is plugged in using a cable to the computer in order to dump the code in it.
4. The device is ensured that it is connected using internet and power bank.
5. Credentials are entered in the telegram app for reading the day and scanning accordingly.
6. The notification during scanning and dropping of books is send to the parent via telegram app with alarming buzzer.
7. The output is viewed also in case of panic situation when the button is pressed in the backpack to check whether it is sending good clarity picture of surroundings along with its location in the telegram app via notification.

The overall system’s block diagram is shown in fig 11.

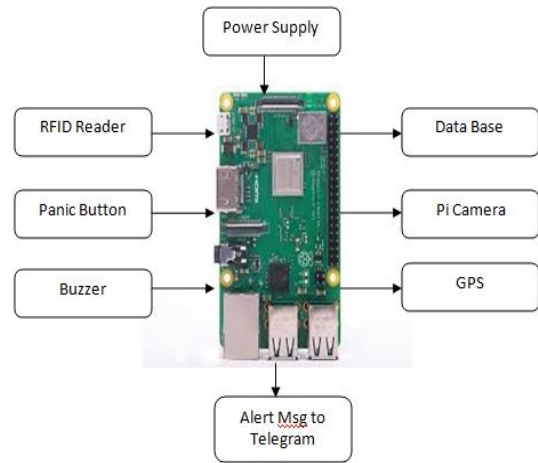


Fig 11: Block Diagram

The system after assembly and implementation is below fig:



Fig 12: System Model

XII. RESULTS



Fig 13: Device scanning the books according to the day

The above fig 13 result shows that when the device is turned on it asks for the particular day so that it can scan the books according to the time table. It also intimates user which books has been dropped and what has to be placed instead of it.

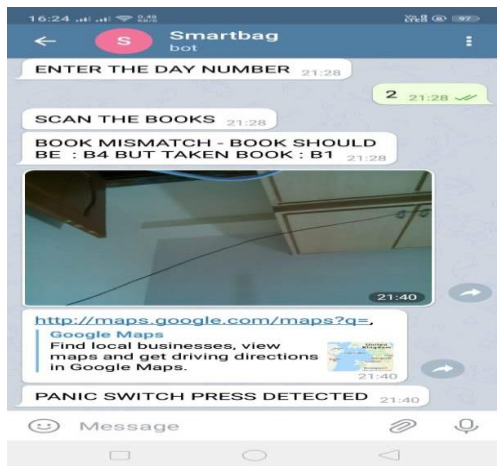


Fig 14: When Panic button is pressed in the Backpack

When panic button inside the backpack is pressed by the student in any abnormal situation the image of the surrounding [7] along with the location attached to it is send to the remote user in order to indicate that their child is in some danger and present in that location [8] that is exactly shown in the fig 14. In case of kidnapping or any abnormal situation this information of image and location can be useful for the cops during their investigation.

XIII. CONCLUSION

In this paper, we have proposed a system based on IOT for remote student monitoring system programmed by Raspberry Pi through a smart backpack. In recent days, it is one of the main security aspect for schools, students and parents. By using small hardware components and software tools which can be accessed by different systems in a backpack for accessing backpack books along with student security in it [6].

XIV. FUTURE SCOPE

By introducing automatic-uploading feature, providing more security for student backpack by scanning the id card for unzipping, we can add bio metric, Automatic sending of assignments, homework's to the parents which can be accessed from anywhere by reducing the hardware complexity in order to provide ease for usability.

XV. REFERENCES

- [1] G. Sowmya, G. Divya Jyothi, N. Shirisha, K. Navya, B. Padmajas, "IOT based smart door lock system", International Journal of Engineering & Technology, 7 (3.6) (2018) 223-225. [Online]: Available. <https://www.sciencepubco.com/index.php/ijet/article/view/14975/6166>
- [2] B. Madhuravani, Dr. P. Bhaskara Reddy, M. Rashmika, "Motion sensor and face recognition based surveillance system Using Raspberry Pi", International Journal of Advanced Research in Computer Science Volume 8, No. 5, ISSN No: 0976 -5697, 2017.
- [3] G. Divya Jyothi, G. Sowmya, K. Navya, N. Shirisha, G. Manisha and Y. Indu, "Shrewd Shelf Management System by Using IOT", Journal of Advanced Research in Dynamical and Control Systems(JARDCS), Volume 11, ISSN 1943-023X, pp. 87-91, 2018.
- [4] A. Venkata Siva Rao, M. Srinivasa Rao, K. Pushpa Rani. "Shrewd

- Street Dividers Driven By IOT Technology", International Journal of Civil Engineering and Technology (IJCIET), Volume 8, Issue 7, July 2017, pp. 385-389, Article ID: IJCIET_08_07_041.
- [5] E Amamatha Reddy, Ilaiah Kavati, K Srinivas Rao, G. Kiran Kumar, " A secure railway crossing system using IoT, International Conference Of Electronics, Communication and Aerospace Technology(ICECA), ISSN Online: 0976-6359, 2017.
- [6] Seong-eun Yoo, Poh Kit Chong, Daeyoung Kim, "School Zone Safety System Based on Wireless Sensor Network", Journal of Sensors, Vol 9, Pages 5968-5988, July 2009.
- [7] S. Granville, A. Laird, M. Barber (September 2002). Why Do Parents Drive Their Children to School? Transport Research Series, Scottish Executive Central Research Unit. [Online]. Available: <https://www2.gov.scot/Resource/Doc/46737/0030598.pdf>
- [8] Ghaith Bader Al-Suwaidi, Mohamed Jamal Zemerly, "Locating friends and family using mobile phones with global positioning system (GPS)," IEEE/ACS International Conference on Computer Systems and Applications, 2009.