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Smart School Bag

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Abstract:
Smart School Bag is an intelligent system presented to assist pupil in their timetable management and also to assure their security. The main part of smart school bag is the minicomputer and the sensors, which collect the real time data, are embedded into the minicomputer. The school bag maintains, the list of books and according to that day's timetable and notifies the user if any book is missing. The teacher can also make necessary changes or even update the schedule. The Panic Button in the system assures the safety and security of the child. If the child feels insecure he/she can press the button, which in turn alerts the parents so that they can act accordingly.

Keywords: Raspberry Pi, RFID, GPS.

I. INTRODUCTION

In the education system now a days, students are required to carry loads of books every day. The students stuff their bags with books and drag them for whole of the week, which result in aching muscles, sore shoulders etc. By implementing a strategy, in which only those books which are required on that certain day could be brought to the school instead of horse-carting the entire syllabus.

Also the kidnapping, molestation and sexual abuse of school-going children are increasing at an alarming rate. A case study done by an independent source stated that around 20,000 kids are lost and trafficked annually in India. There is a need of smart solution to this problem. So the parents might be able to know the whereabouts of their children.

In smart school bag, we have covered all these aspects using RFID tags and RFID reader. Each and every book the studentpossesses is tagged using a RFID Tag with unique ID; the RFID reader identifies the books on the basis of this unique ID. This system notifies the student whether the correct books are going inside the bag or not. Also each smart school bag is connected remotely with a database, which contains the timetable for each day, and if there are any changes to be made in the timetable, the authorized personnel can access the database remotely and can make the modifications accordingly.

The bag is provided with a panic button located on the bag strap, which triggers the panic mode when pressed. On activation of panic mode the camera attached to the system clicks pictures of surrounding and the GPS module collects the location coordinates of the student and transfer the same to the minicomputer and from there the alert notification is sent to the parent/guardian.

II. PROPOSED CONCEPT OF SMART SCHOOL BAG

A. Proposed System

The figure shown below is the proposed conceptual design of Smart School Bag. It clearly highlights all the parts/modules involved in making the prototype. The modules utilized are GPS, RFID and Camera.

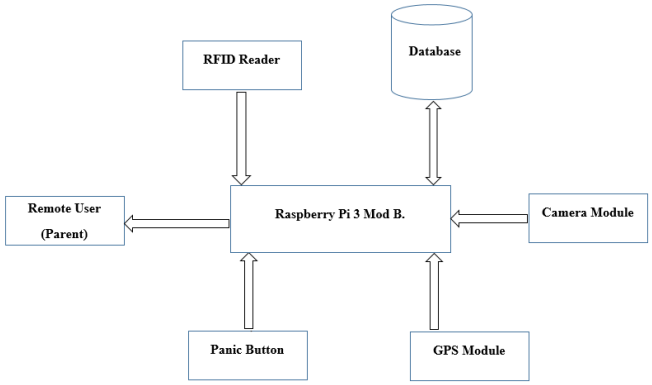

Fig 1. Block Diagram of Smart School Bag

GPS module – This requires the use of GPS receivers. The GPS satellites contain accurate atomic clocks. They are located in the sky and continuously send data down to earth over respective RF frequencies. GPS receivers have tiny processors and antennas that directly receive the data sent by the satellites and compute the position and time. GPS receivers use a constellation of satellites and ground stations to compute position and time almost anywhere on earth. The data sent down to earth from each satellite contains different pieces of information that allows the GPS receiver to accurately calculate its position and time. The time on the atomic clock is sent down to earth along with the satellite's orbital position and arrival times at different points in the sky. From this information, the GPS receiver calculates the distance to each satellite in view. GPS accuracy depends on a number of variables like signal to noise ratio (noisy reception), satellite position, weather and obstructions in the form of buildings, trees etc. [2 – 5].

Here the GPS GY-NEO 6mv2 is used. The power supply range used is from 3 – 5V. Here a ceramic antenna of size 25*25mm is used. EPROM is used for saving the configuration data when the GPS is powered off and there is also a provision of backup battery. LED signal indicator is also used. The module size is 25*35mm and the diameter of mounting hole is 3mm. Default baud rate is 9600 bps.

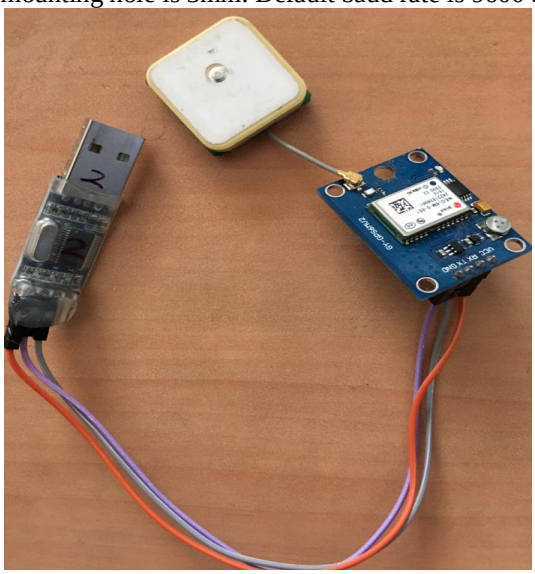

Fig. 2 GPS Module

RFID module - In an RFID system, tags are attached to all the trackable items. These tags are made from a tiny tag-chip connected to an antenna. The tag-chip contains memory, which stores the product's electronic product code (EPC) and other variable information so that it can be read and tracked by RFID readers.Here RFID EM18 module is used. It uses a supply voltage of +5V and a maximum current of 50mA. It communicates using TTL mode. The effective range that can be effectively read is from 5 to 15 cm. The frequency used is 125 KHz and the baud rate used is 9600. It consists of an inbuilt antenna.

An RFID reader is a network-connected device. It also consists of an antenna that sends power, data and commands to the tags. The RFID reader acts as an access point for RFID tagged items so that the tags' data can be available for the required purpose. There are three types of RFID ID tags – passive tags, active tags and semi- passive tags. Passive tags need an external power source so they are the simplest, smallest and cheapest of all the RFID tags. The active RFID tags do not need an external power supply and they get activated when they come in contact with the RFID reader field. Semi-passive tags have built in batteries and they function with low signal power levels. They cover greater distances.

An RFID tag is made up of an IC attached to an antenna (printed onto a mount which is PolyEthyleneTherephtalate). The chip and antenna combination is then sandwiched between a printed label and its adhesive backing. The tag-chip is pre-programmed with a tag identifier, a unique serial number assigned by the chip manufacturer, and includes a memory bank to store the items' unique tracking identifier.

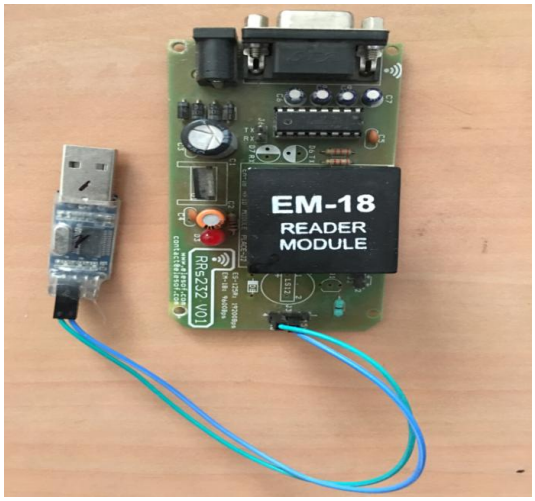

Fig. 3 RFID Reader Module

The Unique Tracking Identifier can be used as a key into a global database to uniquely identify that particular product [4] [6].

Fig. 4 RFID Tag Cards

Camera module -The raspberry pi camera module is compatible with all models of raspberry pi 1, 2 and 3. The board is tiny, at around 25mm x 20mm x 9mm and weighs just over 3g, making it perfect for mobile or other applications where size and weight are important. It connects to Raspberry Pi by way of a short ribbon cable. The camera is connected to the BCM2835 processor on the Pi via the CSI bus, a higher bandwidth link that carries pixel data from the camera back to the processor. This bus travels along the ribbon cable that attaches the camera board to the Pi. The sensor has a native resolution of 5 megapixel, and has a fixed focus lens onboard. In terms of still images, the camera is capable of 2592 x 1944 pixel static images, and also supports 1080p30, 720p60 and 640x480p60/90 video. It can be used to take HD videos and still photographs. Its applications are time lapse, slow motion etc. Libraries can be used with the bundles to create effects. The lens needs to be adjusted for a clear image [7].

Database – It is the collection of organized information in the form of a predefined timetable for pupils that is easily accessible, manageable and updatable. The school bag will be daily arranged according to the specified timetable.

Remote User – Here the parent is referred to as the remote user because they would be the one who would be receiving the GPS coordinates and the image of the panic situation via email.

Panic Button–Panic button circuit is made on a PCB with two pull up resistors, an LED and a connector. When the button is pressed the GPS coordinates and the background images of the student are sent to the parent.

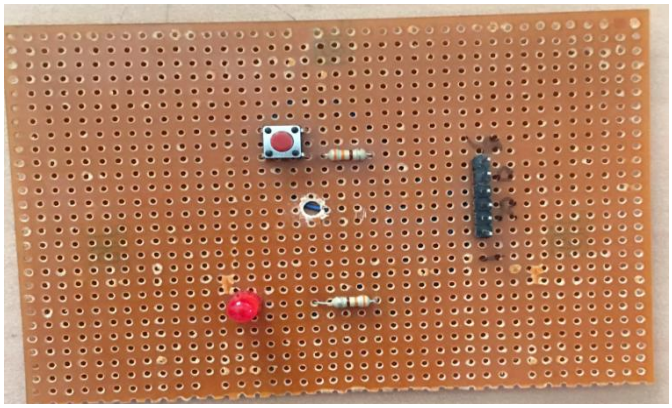

Fig. 5 Panic Button Circuit

B. Methodology

The raspberry pi is initialized and operating system is installed in the SD card, which is then mounted in the slot. A 5v power supply is provided to the raspberry pi. Necessary configurations and required libraries are installed. The touchscreen display, GPS module, the RFID module, Camera module and the panic button circuit are connected to the raspberry pi. The database is uploaded with the information of all the subjects of the particular day, since the database is kept online it can be accessed from anywhere using the internet and hence by which the teacher can update and upgrade the timetable if needed. Each subject is assigned a unique Tag ID. When the system is initialized, it starts reading the RFID Tags and if the book is according to the timetable it will display "Book according to Timetable". If the book is not according to the timetable it will display "Book not according to Timetable". The panic button circuit is connected with the raspberry pi, when the button is pressed the GPS coordinates and the background image of the user's surroundings are sent to the parent via an email otherwise it keeps reading the RFID Tags.

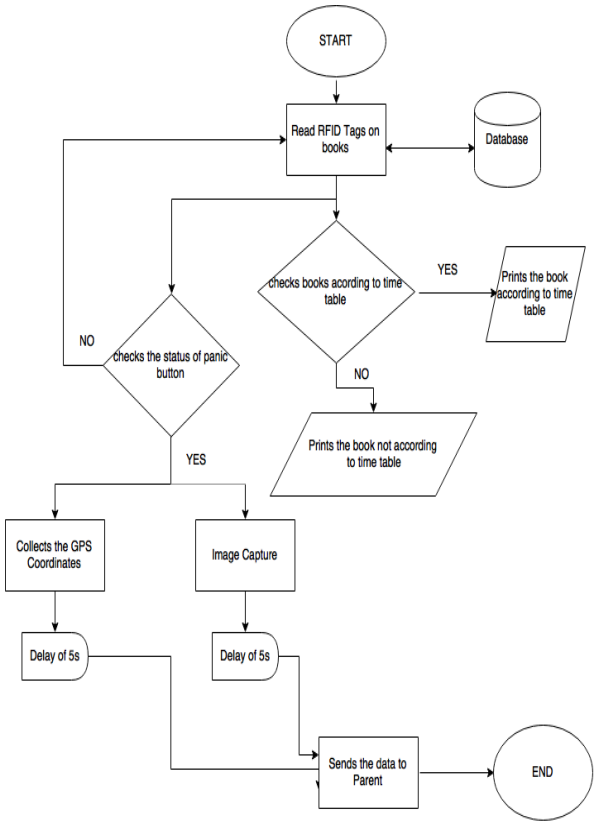

Fig 6 Working

III. RESULTS AND ANALYSIS

In fig. 7 the final prototype of the circuit is shown which is later assembled in the school bag. In fig. 8 the email format of the GPS coordinates is shown and fig. 9 shows the email format of the alert notification email. Fig. 10 shows the exact GPS coordinates of the location of the bag holder.

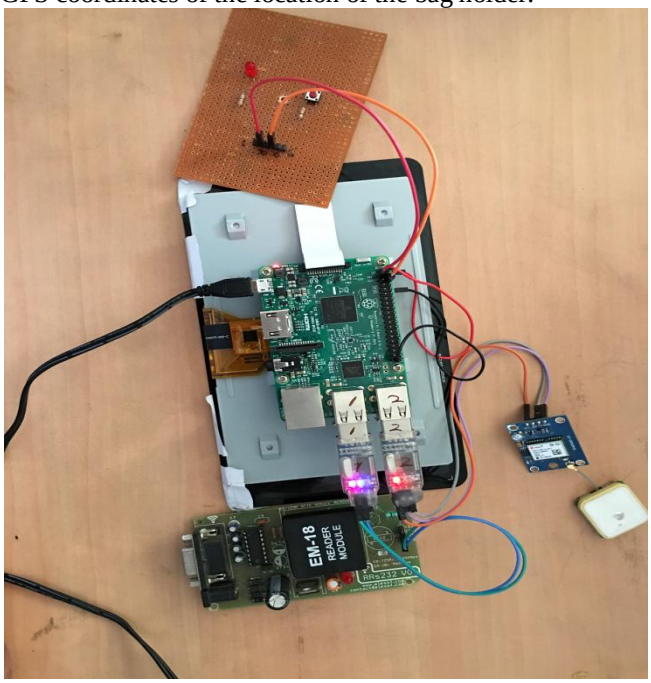

Fig 7 Final Prototype of the Circuit

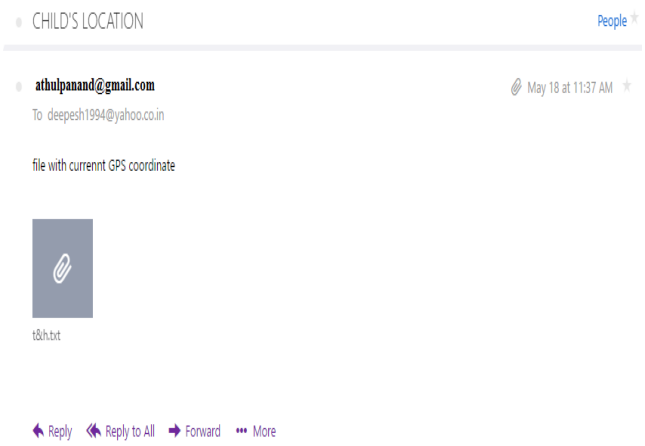

Fig. 8GPS Coordinates email

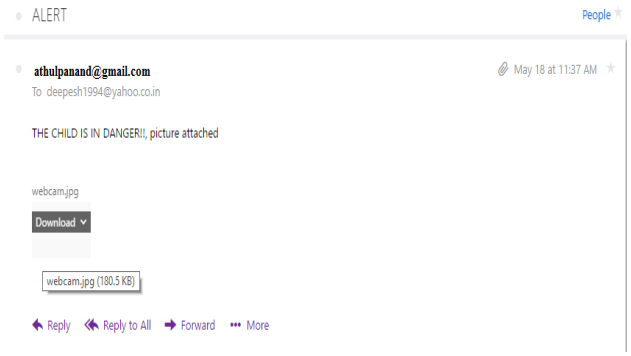

Fig. 9 Alert Notification email

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LŠ%%%%%%ÉÅr©64
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,,,,,,,,N*30
$GPGGA,,,,,,0,00,99.99,,,,,,*48
$GPGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99*30
$GPGSV,1,1,01,13,,,27*7F
$GPGLL,,,,,,V,N*64
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,,,,,,,,N*30
$GPGGA,,,,,,0,00,99.99,,,,,,*48
$GPGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99*30
$GPGSV,1,1,01,13,,,25*7D
$GPGLL,,,,,,V,N*64
$GPRMC,,V,,,,,,,,,,N*53
$GPVTG,,,,,,,,,N*30
$GPGGA,,,,,,0,00,99.99,,,,,,*48
$GPGSA,A,1,,,,,,,,,,,,,99.99,99.99,99.99*30
$GPGSV,1,1,01,13,,,24*7C
$GPGLL,,,,,,V,N*64
$GPRMC,,V,,,,,,,,,,N*53
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Fig. 10 GPS coordinates received

Fig. 11 Image Received by email

The results obtained are favorably good to meet the expectations of the school children security.

IV. CONCLUSION

The developed prototype is attached to an ordinary bag. The smart school bag implements the use of real time system, which accounts for the proper functioning of the RFID system. As soon as the studentpresses the panic button his GPS coordinates and the distress image is sent to the specified email id of the parent. The return information message sent to the parent isan added advantage of preventing the children from kidnapping. In future this proposed methodology can be enhanced by replacing the school bag by a more sophisticated system. The components can be assembled in the school ID or any other portable item. In future the proposed methodology is to be modified by introducing the automatic attendance-uploading feature, immediate result updating on smart school bag, sending assignments and project details to the smart school bag and many others.

V. ACKNOWLEDGEMENT

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VI. REFERENCES

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