Smart Travel Bag

Prathwik R Amin
Department of Electronics & Communication Engineering, Sahyadri College of Engineering & Management, Mangalore 575007, India

Krishna Karanth S
Department of Electronics & Communication Engineering, Sahyadri College of Engineering & Management, Mangalore 575007, India

Sharanya M S
Department of Electronics & Communication Engineering, Sahyadri College of Engineering & Management, Mangalore 575007, India

Akshatha K
Department of Electronics & Communication Engineering, Sahyadri College of Engineering & Management, Mangalore 575007, India

Mr. Manjunatha Badiger
Assistant professor,
Department of Electronics & Communication Engineering, Sahyadri College of Engineering & Management, Mangalore 575007, India

***Abstract*—In an age where time is the best central factor, air travel is the most favored methods for transport. Airports and airlines are the developing worldwide organizations giving air services. The misfortune and mixing of luggage are the most horrendous experience faced by several travelers consistently. Very little is done in this field to assist the travelers with the issues of bag mixing and loss. To help the explorers we have built up the idea of a smart bag. The bag works on the Wi-Fi technology (NodeMCU ESP-8266) interfaced with a controlling unit GPS module, MPU-9250, ultrasonic sensors, power bank, solar cell and so on. The bag can be handily followed for its location by the assistance of GPS technology and MPU 9250 to learn the position and movement of the owner. The smart phone of the traveler controls it and the Wi-Fi technology helps in digital locking, location tracking and identifications along with numerous other exceptionally designed features**.

Keywords—Luggage, GPS module, Ultrasonic sensor, NodeMCU ESP8266, MPU 9250, Raspberry Pi3, Solar panel, L298N motor driver, motor.

I. INTRODUCTION

Automatic or automation means, by an electronic gadget human intervention is limited. This will lessen the time delay and human efforts in luggage management system. Most of the time everyone uses a luggage for traveling and drag it everywhere. Traveler need to carry their own luggage. This is exceptionally moderate and energy tiring procedure. Also, it becomes hectic excursion. This issue can be overwhelmed via programmed luggage follower system or by user controlling the movement of the bag through a mobile application. It is only smart method of carrying a luggage.

It decreases the time postponement and human efforts in luggage management. For the usage of this system ultrasonic sensor and dc motors assumes a significant job. For anti-theft reason GPS is utilized. At whichever point the bag is lost, the user can get to the location by GPS following system and throughout the travel period, its location will be updated to the database. Bag is locked through cell phone. User need not utilize any keys or any pins. In addition, by machine-to-machine correspondence it is made sure about.

A bag is a general term for a recognizable type of luggage. It is regularly a level, rectangular-formed bag with rounded/square corners, either metal, hard plastic or made of fabric, vinyl or leather that pretty much holds its shape. It has a carrying handle on one side and is utilized fundamentally for moving garments and different belongings during trips. It opens on pivots for an entryway.

Probably the greatest advantage of a smart bag is the interior battery and the capacity to charge a mobile device from the exterior USB port on the luggage. Blue smart has a remote locking feature with the goal that the individual can lock or unlock your bag from the application. They can even set the application to consistently leave your bag opened when you're close by, and automatically lock when you're separated. The recently made luggage bag didn't have any of the technology used that we intend to make. The bag was simply used to carry garments, a few things, or some significant records.

Additionally, some of the technologies that were used to make such bag were single application based like one bag had a feature like mobile charging. There are two fundamental types of spinner bags, both are very durable and arrive in an assortment of sizes. Delicate shell spinners are extremely well known and are normally comprised of polyester or ballistic nylon. They are additionally accessible in leather however these can be progressively costly. Hard shell spinner is likewise extremely well known and is available in a range of bright colors. A few organizations offer lifetime warranty on their luggage that they will not break.

In travel life, requirement of power is an important element. Considering this, another element added to this system is power bank. Along these lines, by introducing power bank in the travel bag since the power bank can likewise be charged through power sully and with the use of solar cells, explorer need not stress about electricity supply. Traveler can connect LED bulbs or DC fan to it whenever necessary.

II. LITERATURE SURVEY

The term "smart" originally comes from the acronym "Self-Monitoring, Analysis and Reporting Technology in the early 1990s, IBM engineer Frank Canova realized that

chip-and-wireless technology was becoming small enough to use in handheld devices that could be properly referred to as a "smartphone". Since the word smart was introduced, every utility like smart watch, smart chair, smart mirror and smart bag were introduced. The first successful rolling suitcases was invented in 1970," Sadow applied for a US patent in 1970, and in 1972, he was granted the first successful patent on wheeled suitcases. Macys sold the first suitcases in October 1970. The Rolla board was invented in 1987 by Robert Plath, a Northwest Airlines 747 pilot and avid home workshop tinkerer, who affixed two wheels and a long handle to suitcases that rolled upright, rather than being towed flat like Mr. Sadow's four-wheeled model. As transportation changed, soft-sided suitcases manufactured from polyester prevailed. Now in the 21st century, the German luggage maker Rimowa made the first suitcases of polycarbonate in 2000. Recent years many travel bag companies are developing smart bags. In 2019 Aruna S [1] developed a suitcase using the name intelligent suitcase, which had digital locking system and unique, identified using RFID.

Faculties from Lebanese International University - Department of Computer and Communication Engineering, developed a human Detection and Following Mobile Robot [3] in 2017 using simple Arduino supporting devices and Faculty of Electrical Engineering, University Teknologi Malaysia, 81310 UTM Johor Bahru Johor, Malaysia developed an Automatic Human Guided Shopping Trolley with Smart Shopping System [4] in 2015. Which gave an Idea to be introduce with the bag, which make the bag follow the human. Here distance measurement digital locking was done using Bluetooth technology. .

In 2018 Suvankar Barai and Buddhadeb Sau from Jadavpur University designed an algorithm to Estimate distance measurement using NodeMCU ESP8266 based on RSSI technique [5]. In 2014 Yuxiang Sun, Ming Liu, Max Q.-H, Meng Department of Electronic Engineering, The Chinese University of Hong Kon designed a project named Wi-Fi Signal Strength-based Robot Indoor Localization [6], which strengthened the wireless signal strength and communication between two wireless devices and made wireless device much stronger than Bluetooth. By using Wi-Fi, the communication between user and bag would take place with more distance than Bluetooth.

In 2011, firebase developed a web development platform named firebase which later acquired by Google in 2014. Firebase's first product was the Firebase Real-time Database, an API that synchronizes application data across iOS, Android, and Web devices, and stores it on Firebase's cloud. Firebase along with NodeMCU boosted the development of IOT projects since then. Sourabh Sarkar [7], Android based Home Security Systems using Internet of Things and Firebase. This paper gave an idea of storing data in firebase and helped in home security, which can be monitored by a mobile phone of the user. This method can be implemented for security purpose and throughout the trip, location of the bag can be continuously updated in database.

A solar cell, or photovoltaic cell, is an electrical device that converts the energy of light directly into electricity by the photovoltaic effect, which is a physical and chemical phenomenon. It can be used to charge battery B.E. Research Scholar from Sri Krishna College of Technology, Coimbatore [8], designed a vehicle named Charging Station for E-Vehicle using Solar with IOT which gave an idea of providing renewable source energy to IOT devices. By implementing this technology in bag, it can be converted in to a power station.

III. PROPOSED METHODOLOGY

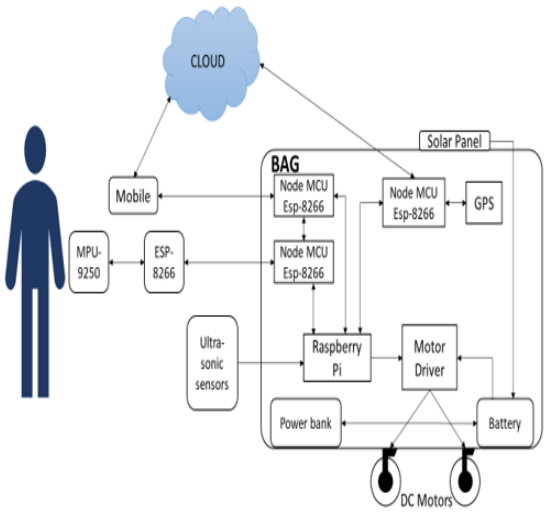

Fig 3.1: Design of smart bag

The proposed strategy (fig 3.1) presents the structure and Development of Smart Travel bag Based on Android System. This is a bag that interface smart phone with the goal that user can remotely control the operations of the bag. After decades, there is no advancement in the luggage business, an technology where the bag is ready to take care of the considerable number of issues of the modern traveler and lead to no more bag nightmares that can ruin our outings. By utilizing this Bag, traveler can travel more astute and be the coolest child in the travel destination.

Bag has three NodeMCU, which will be serially communicating with Raspberry Pi. Pi is the heart of this project, which keep receiving data's from NodeMCU's ultra-sonic sensor etc. and drive the bag. User will have a wristband, which is made up of MPU9250 and esp8266. MPU 9250 gives the speed and direction of the user to ESP, which will send these data to bag. 1st NodeMCU is used communicate via Wi-Fi with esp-01. The Wi-Fi signal strength is also used to measure the distance between the user using RSSI technique [5] by keeping esp-01 as access point and NodeMCU as a station. The distance between bag and user can be determined using friis transmission equation.

TABLE I
To find distance by friis transmission equation for free space propagation [5]

Distance	Largest RSSI Value	Smallest RSSI Value	Average (Round off) RSSI Value	Average Output Power(mW)
0.3m	-51	-58	-55	0.0000031622776602
0.4m	-54	-63	-59	0.0000012589254118
0.5m	-55	-65	-60	0.0000010000000000
0.6m	-57	-76	-62	0.0000006309573445
0.7m	-61	-69	-66	0.0000002511886432
0.8m	-63	-73	-68	0.0000001584893192
0.9m	-67	-72	-69	0.0000001258925412
1.0m	-67	-75	-71	0.0000000794328235
2.0m	-70	-80	-74	0.0000000398107171
3.0m	-73	-87	-79	0.0000000125892541
4.0m	-75	-88	-81	0.0000000079432823
5.0m	-77	-90	-83	0.0000000050118723
6.0m	-78	-89	-84	0.0000000039810717
7.0m	-78	-89	-85	0.0000000031622777
8.0m	-79	-92	-86	0.0000000025118864
9.0m	-81	-92	-87	0.0000000019952623
10.0m	-82	-93	-88	0.0000000015848932

Second NodeMCU is used to communicate with user's android phone. It will be communicating via Wi-Fi which is used to unlock the bag and keep the track of the movement of bag. Mobile phone also communicates via this NodeMCU for the manual movement of the bag and third NodeMCU is used to collect the data's from GPS and update the location of the bag to firebase, which is also accessible in mobile phone.

Built in Battery can be charged using a power supply of via solar cell. The battery can be used as power bank when user needs electricity to charge his electronic gadgets like LED blub or DC fan.

IV. WORKING

From the outset, we need to confirm by means of cell phone. Initial stage is to choose a mode which can be either autonomous or manual mode. If autonomous mode is selected, then there are three stages to consider. First is to estimate the distance of the bag from the user using Wi-Fi strength [5]. Second, by using MPU9250 obtain the movement of the user, that is which direction and how speed the user is moving. Third, by using GPS obtain the exact position of the bag and update the location to data base this NodeMCU is need to be connected to internet to update the location. If internet connection is lost, then it will inform the user regarding the same. Finally, by getting all the information we acquire the route by which the user moves. After obtaining the route, it checks whether there is any obstacle or not using ultrasonic sensor. If we trace any obstacle, then we change the route. Or else it continues to move in the same route. This way it keeps on checking until user give the command stop from mobile. If any communication breaks in this process bag will inform the user about this through notification in the user's mobile phone.

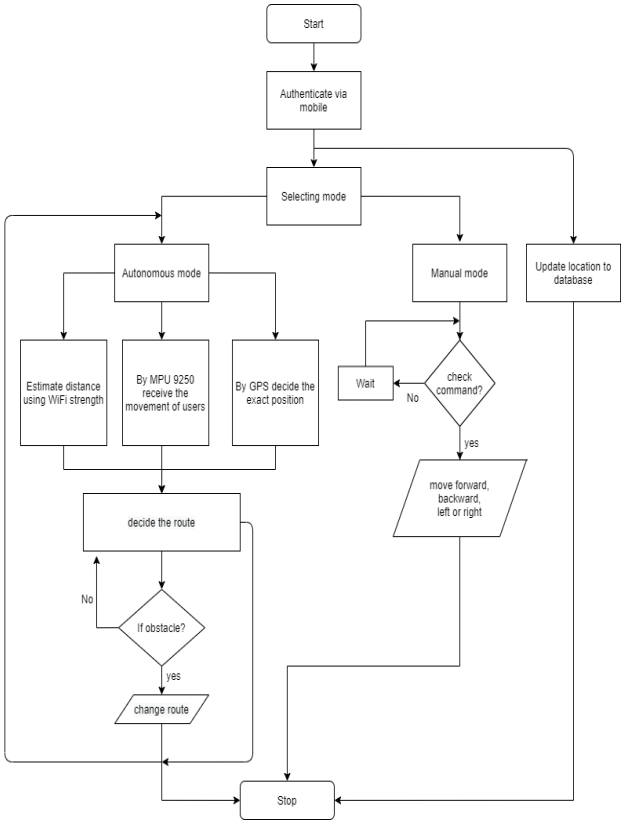

Fig4.1: Operational flow of the model

On the off chance that we select manual mode, it checks for any command given to it. If command is received, then accordingly it moves forward, backward, left or right. If command is not received, then it waits until it gets any command from the user. Finally, it stops when the user says so. Location of the bag will be updated to Database every now and then and can be checked when necessary. The operational flow of the model is shown in Fig4.1, which clearly gives the idea of the working of the smart bag.

Additionally, bag will be attached with dummy wheels so that if user would like to drag the bag those wheels would help him in doing so. If user goes to any remote area while traveling where electricity is not available, solar cell will help in getting electricity and power bank can be used to run LED and DC fan. This power bank can be charged from power supply or also with the help of solar cells, which is already attached with the bag.

V. HARDWARE COMPONENTS DESCRIPTION

a. Raspberry PI:

The Raspberry Pi (fig 5.1) is an ease, charge card measured PC that connects to a PC screen or TV, and utilizes a standard keyboard and mouse. Its skilled little gadget empowers individuals of any age to explore computing, and to figure out how to program in languages like Scratch and Python.

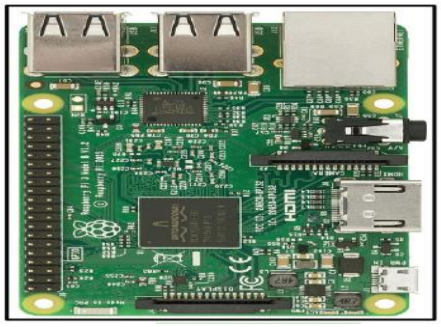

Fig5.1: Raspberry Pi3

In this project, Raspberry PI controls the entire operation taking place in the bag. It keeps on communicating with NodeMCU's and sensors and controls operation. It decides the route of the bag by receiving values as showing in working model fig4.1. Indirectly it also communicates with the user via NodeMCU. It informs the user if any connection is lost or any unauthorized person try to open the bag. It also monitors the battery charging. It checks the charge stored in battery and the power consumption and informs the user if there is any fault in the bag. It also detects the number of steps taken by user using pedometer which will be developed using MPU9050.

b. GPS

Fig5.2: GPS module

Global positioning system (GPS) (fig 5.2) is used to locate the device. It is a satellite-based navigation system used to track and inform the position of the bag. It gives latitude and longitude values to NodeMCU, which will continuously update it in database. By this method, its user can access its position easily via mobile phone. It is used along with GPS module to text message the location displayed by the GPS module to the receiver.

c. MPU 9250

Fig5.3: MPU 9250

The MPU 9250 is a 9-axis Motion Processing Unit for cell phones, tablets, wearable sensors and other consumer items. It is System in Package that consolidates two chips: MPU 6500 which contains 3-axis gyroscope, a 3-axis accelerometer and an Onboard Digital Motion Processor which is fit for preparing complex Motion Fusion calculation; a 3-axis digital compass. It will be with the user serially sensing and transmitting the 9-axis values to esp01. Esp01 will be communicate via Wi-Fi with NodeMCU of the bag. Accelerometer indicates the speed of the user and by using accelerometer and gyroscope values, a pedometer algorithm is developed which will be used to determine the number of steps taken by the user. And compass helps in identifying the direction in which human is moving.

d. NodeMCU ESP8266 and ESP8266 ESP-01

NodeMCU fig6.1b is an open-source firmware and advancement pack that encourages you to model or construct IoT items. It incorporates firmware that sudden spikes in demand for the ESP8266 Wi-Fi S.o.C from Espressif Systems, and equipment, which depends on the ESP-12 module. MCU stands for Microcontroller unit and it can be programmed using Arduino IDE. There will be three NodeMCU in the bag all three will be serially communicating with raspberry pi.

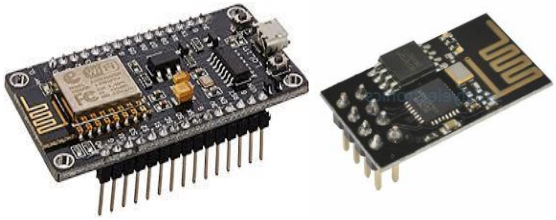

Fig5.4(a) NodeMCU ESP8266, (b). esp-01

The first NodeMCU is used to read MPU9050 values via esp-01. Second NodeMCU is used to update the location in database and third Node MCU is used to communicate with users' mobile phone. ESP8266 ESP-01 is a Wi-Fi microchip (Wi-Fi module) with microcontroller capability developed by Espressif Systems. It has a built in S.O.C thus it doesn't necessarily require and microcontroller to control its function. It is used to read the data's from MPU9050 and send it to NodeMCU in the bag via Wi-FI

e. Ultrasonic Sensor

Fig5.5: Ultrasonic sensor

Ultrasonic sensors measure distance by utilizing ultrasonic waves. The sensor transmits ultrasonic wave and gets the wave reflected once more from the objective. Ultrasonic Sensors measure the distance to the objective by

estimating the time between the emission and reception. Ultrasonic ranging module HC - SR04 provides 2cm - 400cm non-contact measurement function, the ranging accuracy can reach to 3mm. In autonomous mode when raspberry pi decides a route this checks whether there is any is any obstacle in the route and help raspberry pi in changing the route

f. Motor Driver

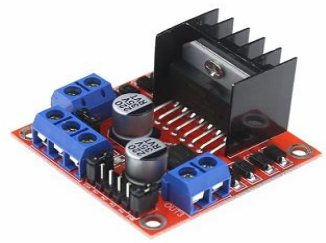

Fig5.6: L298N Motor Driver

The most ordinarily utilized actuator in any electronic gadget/machine will be motors close to solenoids, pneumatics and hydraulics. Motor drivers goes about as an interface between the motors and the control circuits. Motors require high measure of current while the controller circuit takes a shot at low current signals. In this way, the capacity of motor drivers is to take a low-current control signal and afterward transform it into a higher-current signal that can drive a motor. From a straightforward vibration motor inside a cell phone to complex stepper motors in CNC machines, these DC machines can be found all over the place. To control a motor utilizing a Microcontroller or processors we need Motor Driver.

g. Solar Panel

Fig5.7: Solar panel

Solar panels (otherwise called "PV panels") are utilized to change over light from the sun, which is made out of particles of energy called "photons", into power that can be utilized to control electrical burdens. By using DC-DC convertors [8] Solar cell can be used to charge the battery in the bag. Power level ranges from very low to very high that is from small batteries to high voltage power transmission. Closed feedback loop will maintain a constant voltage output even with changing input voltage and output current. Some common dc-dc topologies are (i) Buck converter, (ii) Boost converter, (iii) Buck-Boost converter and (iv) SEPIC Converter.

VI. ADVANTAGES

- Digital locking system will help the user secure the items inside the smart bag with the help of dynamic encryption, which will safeguard the bag by Machine-to-Machine Communication.
- GPS tracking system along the location notifications.
- It can be utilized to charge any electronic gadget.
- Unique ID for every bag can be shown.
- Carry-on size with Rolled Travel luggage
- The bag is intended to follow the owner all alone without the need of hauling it.
- If lost or stolen the data stored in database can help in finding the bag. This also helps the cops in finding the bag in case of any theft.
- Travel made safe.

VII. APPLICATIONS

- Explorers utilize it as it gives burglary prevention.
- The bell can likewise help in recognizing the smart bag on the off chance that it gets lost.

VIII. CONCLUSION

The significant point of the project is to complete design and activity of smart luggage from the engineering point of view and to make an upgraded working model of luggage bag incorporated with sensors which makes the structure extremely special. Our fundamental target was to block a Bluetooth enabled luggage bag with Arduino technology which can be utilized for travelling, hostile to robbery insurance, cell phone charging. In future element like advanced lock that can be utilized to lock/unlock the bag. Additionally, we can GPS module to follow the bag in case it is lost.

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