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The Smart Luggage System

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Abstract —The airports and the railway platforms are one of the busiest areas where people need to tow their luggage, other than their own backpacks and other stuff which makes the task even more tedious. Our aim is to develop a robot-based luggage capable of manoeuvring through busy airports behind its owner while hauling his or her luggage. In this project, we consider the technique to be used to trail people and report on the realization of a mobile robot capable of following a person. In order to follow a human, a mobile robot needs to know the position of the person and must be able to determine its own path in order to follow his target. The smart luggage system will be a luggage that will follow the user throughout any flat surface without the need of the user to use force to drag it. No effort will be applied by the user in order to carry different load magnitudes. The smart luggage system have a Bluetooth module HC-05 which will receive control signals from the phone's Bluetooth. The smart phone's gyro sensor can be used for the forward movement of the luggage and to control the directions of the luggage. This project also aims to provide a portable charger that can be fixed into the luggage itself. This helps the users to charge their phones on their way of travel.

Keywords- Gyro sensor, Bluetooth HC-05, control signals.

Introduction

Luggage is a place to keep things of its user in transit. It has many design changes since its origin. All the changes have made the luggage easily transportable. Each time the luggage had an upgrade it transformed its handling facilities but it also made itself vulnerable to theft, and also causing many problems to its user. In present day, the luggage is not compatible with the current smart life of the people. In Airports and Railway stations, a lot of travellers and passengers find it difficult to carry or tow their luggage and travel bags. Especially the elder people and physically challenged find it more difficult to travel with their luggage. In order to overcome the above said problems the luggage is been designed from inside out.

A new prototype of a luggage should be designed from the scratch in order to overcome the problem of carrying the luggage which is more user-friendly. The luggage should follow the user wherever he/she moves. But the movement of the luggage should be in full control of the user so that the luggage does not get misguided. Nowadays, every passenger owns a smartphone and hence an android application can be designed which can

used by the passenger/traveller to control the movement of the luggage. They wait for the user to send the commands. Hence the user can have a full control of the luggage movement wherever he/she moves. So the user finds the luggage movement much easier.

Existing System

As we have understood the existing bag there are a lot of problems with it. The previously made luggage bag did not have any of the technology used that we plan to make. The bag was just used to carry clothes or some items or some important files. Also, 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 is no particular existing system that can control the luggage movement with the help of a mobile application which the user can use to control the movement of the luggage. The typical old luggages need to be carried along. The further advancement of the luggage includes the installation of the four or two wheels at the bottom depending upon how much the luggage can carry. These type of luggages were called as trolleys that needs to be pushed or pulled manually. There were no automatic systems that can automatically move.

Image Processing can be used in the luggage system that can automatically follow the user. The user's skull needs to be scanned using Digital image processing system and it can be programmed to follow the user based on the image scanned. But with the problem with this methodology is that the luggage needs to be handles by a single user whose skull has been scanned. Hence this limits the usage of the luggage handling and it needs to be handled by only a single user. This in fact can increase the security of the luggage handling but has a serious mentioned limitation.

Proposed System

The proposed system consists of a Bluetooth module prototyped in the luggage itself that can be connected to the smart phone's Bluetooth. This type of serial Bluetooth connection between the smart phones's Bluetooth and the Bluetooth module HC – 05 is used to transmit the user's control signals to the arduino and the motor drive to drive the DC Motors which are connected to the luggage wheels. One of the biggest benefits of a smart suitcase is the interior battery and the ability to charge a mobile device from the exterior USB port on the luggage**.** Few features and some add on together in a single bag thus increasing its applications and efficiency as well as reducing the cost of purchasing multiple bags. The proposed solution is to use a Bluetooth-enabled smartphone with the desired application which would connect to the system.

Components Used Arduino

An Arduino is actually a microcontroller-based kit which can be either be used directly by purchasing from the vendor or can be made at home using the components ,owing to its open source hardware features. it is basically used in communication and in controlling or operating many devices. It was founded by Massimo Banzi and David Cuartielles in 2005. The Arduino Uno is a microcontroller board based on the AT

mega328 (datasheet).It has 14 digital input / output pins (of which 6 can be used as PWM outputs), 6 Analog inputs, 16 MHz crystal oscillator, a USB connection, a power jack, an ICSP header and a reset button .It contains everything needed to support the microcontroller; simply connect it to a computer with a USB cable or power with a AC-to-DC adaptor or battery to get started. The Uno differs from all preceding boards in that it does not use the FTDI USB-to-serial driver chip. Instead, it features the ATmega8U2 programmed as USB-to-serial convertor.

Bluetooth Module – HC 05

Bluetooth is a wireless technology standard invented by Ericsson in 1994 for exchanging data over short distances using short-wavelength UHF radio waves (Range: 2.4 to 2.485 GHz) from fixed and mobile devices. This is in the globally unlicensed (but not unregulated) Industrial, Scientific and Medical (ISM) 2.4 GHz short-range radio frequency band.

HC-05 module is an easy to use Bluetooth SPP (Serial Port Protocol) module, designed for transparent wireless serial connection setup. The HC-05 Bluetooth Module can be used in a Master or Slave configuration, making it a great solution for wireless communication. This serial port Bluetooth module is fully qualified Bluetooth V2.0+EDR (Enhanced Data Rate) 3Mbps Modulation with complete 2.4GHz radio transceiver and baseband. It has range up to <100m which depends upon transmitter and receiver, atmosphere, geographic & urban conditions. It uses serial communication to communicate with devices. It communicates with microcontroller using serial port (USART). It is IEEE 802.15.1 standardized protocol, through which one can build wireless Personal Area Network (PAN). It uses frequency-hopping spread spectrum (FHSS) radio technology to send data over air. It is used for many applications like wireless headset, game controllers, wireless mouse, wireless keyboard and many more consumer applications

ARDUINO	HC-05 MODULE
+5V	VCC
RX	TX
TX	RX
GND	GND

Table 1: Arduino and HC-05 connection

Gyro sensor

Smartphones today come with a wealth of sensors to facilitate a better user experience, provide apps with enhanced information about the world around the phone and provide robust and increased battery life. Accelerometers in mobile phones are

used to detect the orientation of the phone. The gyroscope, or gyro for short, adds an additional dimension to the information supplied by the accelerometer by tracking rotation or twist. In 1817 Johann Bohnenberger created the first known, gyroscope, called it simply the “machine”.

Vibration gyro sensors sense angular velocity from the Coriolis force applied to a vibrating object. The motion of a pair of sensing arms produces a potential difference from which angular velocity is sensed. The angular velocity is converted to, and output as, an electrical signal. A gyroscope is a device for measuring or maintaining orientation, based on the principles of conservation of angular momentum. Detects when an object is near to the phone. Most commonly used to sense when a phone is held up to the users ear to turn off the display. This saves both battery life and prevents accidental screen touches.

Working Principle

An arduino is used as a micro controller due to its compatibility and user friendly nature. A Bluetooth module HC – 05 is used as for communication between the smart phone’s Bluetooth and the micro controller. The Bluetooth connections follows a Serial Port Protocol (SPP) and serial communication occurs between the two connected devices. Serial communication involves the communication of bits one after the other serially. The arduino micro controller is programmed accordingly to receive the information from
the serial communication Bluetooth and drive the motor shield to run the DC motors accordingly.

Arduino Bluetooth App

Whenever the user needs to control the movement of the luggage in the areas of consideration, he/she needs to connect the smart phone to the arduino placed in the luggage bottom. This connection is done by switching on the smart phone’s Bluetooth and providing a password of either “1234” or “0000” in order to connect it to the HC – 05.
When the connection is perfectly established it displays a message as “Connected to HC – 05” in the smart phone.

Now, the user needs to install the open source Arduino Bluetooth control app that is available for free of cost in the play store. The app includes a lot of features to control the luggage such as voice control, buttons, arrows, terminals and accelerometer. Here, the user can make use of the accelerometer which uses the smart phones’ gyro sensor. The accelerometer option is clicked and the user need to move the smart phone according to the user’s wish of the luggage movement. For instance, when the smart phone is pushed forward, the gyro sensor gets triggered which in turn transfers the information to the micro controller through the serial port protocol of the serial communication between

the Bluetooth devices. Finally the luggage moves forward. Likewise, the luggage directions such as right, left and reverse can be controlled by the smart phone's gyro sensor.

Project Result

The final project output results in a smart luggage system that can automatically move based on the movement of the accelerometer of the user's controlled smart phone. The movement of the accelerometer is actually tracked by the gyro sensor that is prototypes within every smart phone. This movement is transferred to the micro

controller through the Bluetooth communication. The control signals can be viewed in the Arduino IDE Serial monitor. The Arduino Serial monitor basically displays the output of the serial communication between the HC-05 and the smart phone's Bluetooth.

Fig 2: Sample Output

The base of the luggage has been designed and fabricated using mild steel of 1mm thickness. The mild steel at the bottom gives a rigid look to the luggage and makes it with stand to heavier loads of luggage. The four DC motors can be seen fitted along the sides of the bottom of the luggage that can be made to run the wheels. The DC motors are connected in such a way that the left side of the motors are connected together as a single connection and as the same way for the right side motors. The fabricated base of the luggage has been shown below.

Fig 3: Fabricated base of luggage

Applications

- The smart luggage system is mainly aimed with a view of providing an easy luggage management at the airports, railway stations and places where people find it difficult to carry their luggages or tow their trolleys
- The proposed system can be much of help to the elder people and physically challenged people and people who find it difficult to carry their luggages due to various reasons and who travel quite often. They find carrying their luggage as a burden.
- The proposed system can be used to charge the user's smart phones and other electronic gadgets on their way of travel, preventing the usage of power banks and chargers.
- The further development of the proposed system can be used to track the luggages if they get misplaced or being stolen.

Advantages

- Easy luggage management at the airports and railway stations.
- The proposed system creates a hassle free environment to the user.
- The elder people and the physically challenged people find it easier during their period of travel.
- The entire proposed system prevents the luggage carrying concept or towing the heavy luggage.
- Luggage misplacement can be avoided
- Smart phone control of the luggage makes it more compatible and user friendly.

Future Scope

This smart luggage system can be made even smarter and compact by further development on its design procedures. Efforts can be taken to make the luggage more compact and stylish. Various changes in the placement of the wheels and the rigidity of the luggage can make it more user friendly to carry heavy and large loads of User's apparel and other electronic stuff. Image processing can be embedded in with a view of bringing secure nature to the luggage as digital image processing in this embedded

system will allow the luggage to follow only one user at a time. Other perspectives of controlling the luggage movement like hand gestures, artificial intelligence using IoT can be to implement the same.

Fingerprint and other biomedical security devices like iris scanner and face unlock etc., can be embedded within this system with a view to provide more secureness. Location based GPS system can be used to track the luggage's live location that can be viewed with the help of an android application in a smart phone. Portable chargers can be imparted within this smart luggage system that can be used to charge the smart phones and other electronic gadgets, like speakers and laptops, on the way of travel. This prevents the carriage of an extra chargers or power banks during his/her travel. The portable charger designed can supply up to 3V to 5V depending upon the electronic device that is connected to it. The portable chargers can be designed in such a way that they can be recharged whenever they are in low voltage level.

Conclusion.

In this paper, we addressed various design stages of a smart luggage that is envisioned to carry the owner's luggage through crowded air terminals, railway stations etc., and follow the owner. The machine is developed to be affordable for a new invention that can lead to new applications to aid humans further. This project presented a method to achieve human following behaviour as a first step toward the development of an intelligent escort robot moving along with a person.

As future work, further investigation is needed to assess the robustness of these methods and develop new approaches to cope with situations when the robot cannot detect humans. This project is also planning to make experiments using sound generation to inform the status of the robot to the human in order to realize a smoother interaction.

Here this proposed system for designing smart suite cases which are more than just suite case. They are embedded with communication module that can be controlled and communicated via a smart phone. It has been tested it is a very effective system for fellow travellers who carry valuable things. Hence this project achieves to develop an attractive and stylish luggage that can be controlled anywhere and anytime wirelessly by a smart phone. This creates an easier way of luggage management for the passengers and travellers at the airports and railway stations and other crowded areas.

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