Human Following Intelligent Tray System

Surya U.M.
Computer Science and Engineering
SRM Institute of Science and Technlogy
Chennai, India surya0898@gmail.com

Akash R.
Computer Science and Engineering
SRM Institute of Science and Technology
Chennai, India
akashramesh13@gmail.com

KNK. Samraaj
Computer Science and Technology
SRM Institue of Science and Technolgy
Chennai, India
kumarasamysamraaj@gmail.com

C.SABARINATHAN
Computer Science and Engineering
SRM Institute of Science and Technology
Chennai, India
sabaricsn@gmail.com

***Abstract*— In the course of recent year's scientific knowledge has been radically changing the lifestyle in the general public, consequently lives for the present age, has been fundamentally improved by totally getting reliant on new advances. In this proposal, we tried to accomplish a semiautomatic or smart tray system that wants a minute manual work but can carry any amount of weight based on the battery backup, motor's torque and speed. Indeed, even a crash happens if obstructions emerge far out. Smart Tray system works with the help of PIC microcontroller and other sensors which are used to identify the presence of a user. Travelers often face problems as it causes inconvenience to push or pull these trolleys around and turns out to be observably painful to carry the heavy luggage. The human following smart tray is a non-traditional tray that has the capability to follow the human rather than being taken on by the human. While carrying the luggage the Smart tray acts as an obstacle avoiding human following robot. Ultrasonic sensors produce a high-frequency sound wave and get the reverberation reflected by the objective. A transmitter and receiver sensor are used to communicate with the mobile. The mobile application is designed such that the mobile and the tray can communicate with each other. The human following tray uses the mobile's accelerometer sensor's output to know how to the direction of the user and to move towards that particular direction. The human following tray has a MEMS sensor which helps in guiding the direction for the tray by providing the axis correspondingly. The microcontroller after receiving the input from the Ultrasonic sensor and the accelerometer provides the output for the four-channel relay which controls the DC motor and in turn, it controls the direction of the wheels. Our point is to structure a shrewd tray that follows the human that can avoid the travelers in carrying heavy luggage.**

Keywords—Tray, DC motors, Ultrasonic sensors.

I. INTRODUCTION

In the fastest-growing scientific world, Automation is an emerging technology in the field of research and development. Luggage carrying Trolley is used in order to aid travelers to carry their belongings. The travelers have to push the heavily loaded trolley around the airport or railway station. Travelling is one of the regular tasks in our day to day life. Nearly six million passengers travel across the world every day. The luggage is generally being either pulled or carried by the passengers. This involves in a tremendous human effort to perform these tasks. So moving the luggage around the airport or railway station could be difficult for the passengers. This human following trolley simplifies this task by carrying the luggage automatically. A vast amount of manual work and time could be saved by the implementation of the concept. The goal of the proposal is to implement an automated human following intelligent tray that offers great convenience to the travelers, which eliminates human labor to push or carry heavily loaded trolleys. The tray can therefore, reduce the manpower and can reduce the cost of workers hired. The design consists of the following modules a microcontroller that drives the 12V DC motor accordingly to input that is given from the other sensors such as the ultrasonic sensors, the mobile which controls the tray and MEMS sensor that is used to provide the axis in which the tray has to move. Ultrasonic sensors are fixed in order to detect the accessible path. The tray is provided with a fourchannel relay that controls the direction of the wheels based upon the input from the MEMS sensor and controls the DC motor for movement of the tray. This smart tray, that automatically follows the human and carry their luggage, which makes traveling easier and efficient.

II. LITERATURE REVIEW

With the advancement of hardware in the course of recent years, increasingly more practical methodologies have been proposed to supplant traditional techniques in the improvement of advances. So far a great deal of research has been done on the sorts of the robot that fall into the classification of the "Helping Robots". Individuals have utilized various rationales and algorithms to execute their structure. The entirety of their essential spotlight has completely been on the structure of robots that follows humans. Human Follow Tray is a non-traditional tray that possesses the potential to come after human beings rather than being taken over by the traveler. There are various factors that cause us to carry luggage's quite an unwilling task ex. An elderly person may struggle to carry their heavy luggage around the airport or station, etc. Then there's also the fact that the improperly designed trolley can cause strain in our muscle. Muscle strain is an injury to muscle as a result of an arduous activity. This could affect anyone due to the sudden lifting of excessive weights. The handicapped and mature age individuals feel entirely awkward and difficulties in pushing the trolley. There could be various reasons for a person not to carry their luggage when they are traveling.

Laser sensor is utilized by Burgard in his tour manage robot for human following [1]. Nicola, Husing utilized a system for bringing up various styles of development by utilizing LRF [2]. This data was melded with the data acquired by the camera. Songmin Jia used deep imaging techniques to complete the identification of the persons. The model of an individual was resolved to utilize the depth imaging technique [3]. An individual's model was overcome using the technique of depth imagery. The researchers are designing various algorithms for the detection purposes. Laser was utilized in an investigation to discover the style of the moving legs, and the camera was utilized to detect a specific article or individual [11]. Another technique was also used by the researchers. In this technique,

both the human and the robot used distance sensors. These sensors emit radio waves and were detected on the person to be tracked by the sensors [9]. The problems existed with line following technique too. It is hard to utilize the line following strategy in regions where there is any line break. The currently in use manual tray is considered to be a major challenge for all passengers, based on the surveys carried out at Airport.

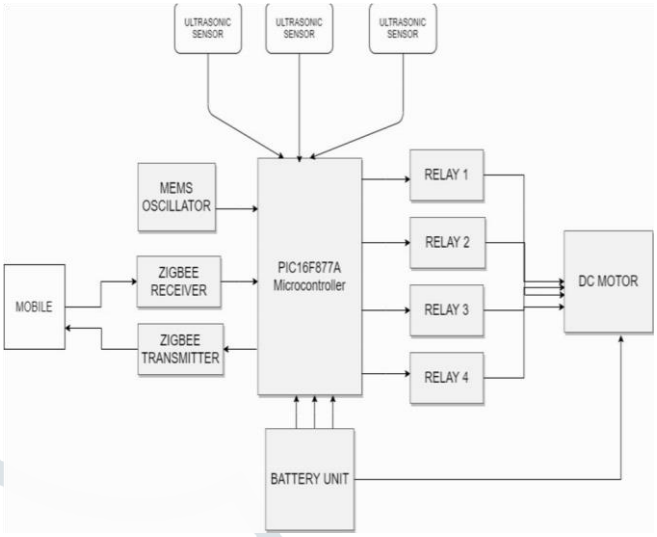
Recent developments in business and academia clearly illustrate the fact that automation will be humanity's future. Subsequently, the work like this will give an additional lift to the equivalent.

III. PROPOSED SYSTEM

The human following tray consists of a PIC16F877A microcontroller. The microcontroller is installed on the tray and two DC motors are connected to the microcontroller. The tray contains a Zigbee receiver and a transmitter that can be able to communicate with the mobile device to get the inputs from the device to which it is connected. The Zigbee is connected to the microcontroller. The tray follows the mobile device using the inputs received from the device. The Ultrasonic sensors are positioned on the tray in such a way that the sensors help in detecting the obstacles that occur in its path. The Ultrasonic sensors provide the proximity between the obstacle and the tray to the microcontroller such that the microcontroller computes on the other possible path if any obstacle is deducted. The Micro-electrical-mechanical system(MEMS) accelerometer is attached to the microcontroller. The MEMS accelerometer is a 3 axis accelerometer which provides the axis in which the tray has to move so that it can follow the direction of the device that is connected to the tray. The tray consists of a four-channel relay module. The four-channel relay module is used for the communication between the microcontroller and the DC motor. The microcontroller after processing the inputs from the other sensor it provides an output to the DC motor so that the tray can move. The four-channel relay module bridges the communication between the microcontroller and the DC motor. The relay actuates the suitable motor and the direction of the wheels so that the tray can move in any four directions based on the user's movement. The entire electronic components and the DC motor is powered by 12V 7.2 Ah sealed battery. Therefore, this proposed system allows travelers to have a hassle-free travel experience by preventing them to carry huge luggage.

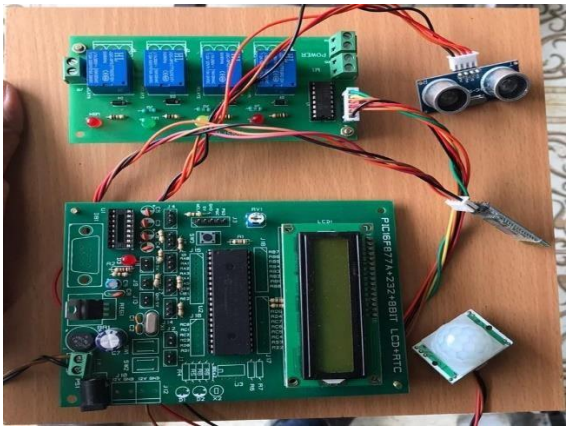
IV. ARCHITECTURE DIAGRAM

A. Communication between the Tray and the user



B. Tray with components

C. Components Kit



V. MODULE DESCRIPTION

A. Microcontroller

In this project, the microcontroller used is the PIC16F877A. The PIC16F877A is an 8-bit microcontroller and it is CMOS flash based. The microcontroller features a program memory of 14KB in size and 256 Bytes EEPROM data memory. The microcontroller comes in a 40 pin package. The maximum CPU speed is 20Mhz. The PIC has the following Data communication peripherals UART -1, SPI -1 and I2C1MSSP – 1. The microcontroller operates within a temperature range between -40 to 125 °C and the working voltage is extended between 2 to 5.5V.

B. Sensors

The Ultrasonic sensor which is used is 40kHz frequency sensors. Three sensors are placed in this tray. The operating voltage for the ultrasonic sensor is 5V. The efficient working range of the Ultrasonic sensor is between 3cm to 400cm. The Ultrasonic sensor has a detecting angle of 30°. The Ultrasonic sensors are positioned in such a way that the tray can avoid the obstacles. The sensor has an input pin, trigger and one output pin, these pins are connected to the microcontroller.

C. Transceiver

The Zigbee is the receiver and transmitter that is used in this project. The Zigbee uses higher-level communication protocols. The Zigbee is based on the IEEE 802.15.4 protocol standards. The Zigbee can be used for the communication purpose between two devices which doesn't need a higher data transfer rate. The Zigbee works using the 2.4GHz frequency and can have the data transmission rate of 250 kbps. The Zigbee works on the mesh topology. The communication range for the Zigbee can be ranging from 75 – 100 meters.

D. Accelerometer

The accelerometer used here is the MEMS accelerometer. The MEMS accelerometer can be used to measure the physical parameters like the acceleration and the direction. The operating voltage for the 1.71 to 3.6V. The MEMS accelerometer is suitable for low power applications. The accelerometer is attached to the microcontroller to process the direction.

E. Power Supply

The power supply that is used here is the 12V 7.2Ah battery. The battery has an output capacity of 86.4W. This battery used powers the DC Motors and the other components such as the microcontroller and other sensors that are used in this tray. The battery unit which is used is a rechargeable battery such that the battery can be used once again after recharging.

VI. CONCLUSION

This human following tray can be used to hold the luggage, which will provide the travelers with a safer option instead of dragging or moving their luggage in the near future. This alternative solution will provide a hassle-free traveling experience for the travelers as this solution eliminates the physical work that a person has to do when they are carrying their luggage. This project is developed in such a way that it takes into consideration the cost efficiency and power consumption and it is maintained to be minimal. With the help of this automatic following tray, the airport and station management can easily implement this project for the benefit of travelers. Travelers may also enjoy their journey as this tray eliminates physical work that has to be carried out in carrying their luggage. As a result of an automatic following cart, the human efforts can be completely ejected and traveling experience can be taken to the next level. In this evolving technological trend, human comfort is the primary factor and this following tray is worth marketing one.

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