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VISITOR COUNTING AND ANNOUNCEMENT SYSTEM BASED ON ULTRA SONIC SENSORS

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Abstract - Visitor counter is a reliable circuit that takes over the task of counting number of person's visitors in the room. When somebody enters into the room then the counter is incremented by one. The total number of persons inside the room is displayed on the LCD, announced through speaker and updates website through wifi. The Raspberry pi 2 microcontroller does the above job, it receives the signals from the sensors, and this signals operated under the control of software which is stored in memory. It can be used to count the number of persons entering and leaving the room. As the persons enter, the count is incremented and vice versa. This circuit divided in three parts: sensor, controller and output. In this circuit, two IR-UWB sensor modules are used. Whenever an interruption is observed by both the sensors in forward direction, it increments the counter value. Similarly, an interruption is observed by both the sensors in backward direction, the count is decremented. The count value is calculated depending upon the sensors input and is displayed on LCD. The complete kit is controlled by Raspberry Pi 2 module. The raspberry pi 2 device looks like a motherboard, with the mounted chips and ports exposed, but it has all the components you need to connect input, output, and storage devices and start computing.

I. INTRODUCTION

The "Internet of things" (IoT) [1] [2] is becoming an increasingly growing topic of conversation both in the workplace and outside of it. It's a concept that not only has the potential to impact how we live but also how we work. This is the concept of basically connecting any device with an on and off switch to the Internet (and/or to each other). This includes everything from cellphones, coffee makers, washing machines, headphones, lamps, wearable devices etc.

Nowadays IoT is being used with the combination of many sensors. Impulse radio ultra-wideband (IRUWB) radar sensor is also one of the things in this trend. The IR-UWB radar sensor is attracting attention as an intelligent sensor that can be easily used as an embedded type sensor with a simple hardware configuration [2] and can be used in various applications.

II. RELATED WORKS

In the past decades, there were mainly three types of counting techniques [6, 7]

Counting by detection: This kind of method allows to count people by a detector designed to detect each individual, for example, pedestrian detector, face detector and head-shoulder detector. In pedestrian detection approach, a binary classifier is trained using common features, such as Haar wavelets and histograms of oriented gradients (HOG) [5]. Then the trained classifier can be applied to search for pedestrians by sliding window in the image pyramid. The detection performance can be further improved by deformable parts model. Pedestrian detection is distortion insensitive due to pyramid window search and deformable parts model, which leads to cross-scene counting techniques

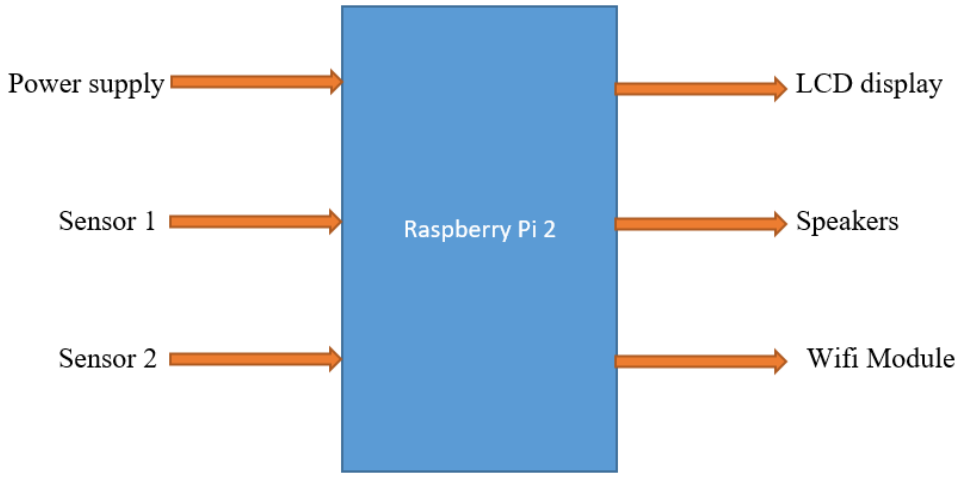
Counting by statistics: These methods adopt machine learning techniques directly to learn a mapping from low-level features to people counting in a scene. Among extensive machine learning methods, regression methods [1–3, 5, 9–12] are the most popular in crowd counting. Gaussian process regression method to obtain the correspondence between the features of each segmented region and crowd number. Vector regression method to learn the mapping from features based on the salient points to crowd number. Piece-wise linear model with dynamic features selection to deal with low and high occlusions. Viewpoint invariant feature and used a single hidden layer neural network as a regressor. Quadratic regression [4], and a novel feature based on flow velocity field estimation was considered as input of quadratic regression. Template matching method, followed by a linear regressor trained to predict the number of people. Although these type methods need some elaborate work, including feature selection and off-line training stage, they are more robust and efficient than that of detection based for a high-density crowd scene. Therefore, they gain extensive popularity in crowd counting problem.

III SYSTEM CONFIGURATION

System Configuration

We use two IR-UWB radar sensors equipped to count the number of passing people. The propagation direction of the radar is perpendicular to the moving direction of the human, which forms a kind of invisible two thin electronic layers to simultaneously count a number of passersby.

The reason for using two radar sensors is to recognize the direction from left to right, or from right to left, of the moving human. That is, through two thin electronic layers, a human passing by radars is detected, and counting is performed in both directions. For this purpose, the two radar sensors are designed to be spaced by a certain distance d. If the distance d is wider, the difference time between the timing when the human passes through each radar sensor becomes larger, thereby making the recognition of the passing direction easier. However, if d large, before a human passes completely through the beam width of the radar, the human behind the followed human can come into the radar beam width, making ambiguity in radar signal. The ambiguity causes performance degradation. Conversely, if d is made too narrow, the time difference for the human to pass the two radars is reduced, and the accuracy of the direction recognition is decreased.



Fig[1] Block Diagram of Visitor Counter and Announcement system based on Ultra Sonic sensors

The radar signal processing described in this section was originally designed for signals provided by the pseudo-noise UWB radar system using the maximum length-binary-sequence (M-sequence) as the stimulus signal [13]. As the signals acquired by the M-sequence UWB radar have a form of the impulse responses of the environment through which the stimulus signals are propagating, the same processing procedures can also be directly applied for signals obtained by means of some other kinds of UWB radars, e.g. impulse UWB radars

IV PEOPLE COUNTING ALGORITHM

- One of the goals is to estimate the number of persons passing through a door or entering into a room and leaving the room.
- Here, two IR-UWB radar sensors equipped with antennas which have narrow beam width to count the number of passing people.
- This two radar sensors are used to recognize the direction from left to right, or from right to left, of the moving human.
- That is, through two thin electronic layers, a human passing by radars is detected, and counting is performed in both directions.
- When the transmitted pulse hits the human target, part of it is reflected due to the high reflectivity of the body.
- Here the mutual information between two sensors and the information of the individual is taken into consideration for detection.

V. EMBEDDED IMPLEMENTATION

We designed module for implementing the proposed people counting system. The hardware used in the module includes two radar sets for transmitting and receiving impulse signals, one Raspberry Pi 2 module for signal processing of two radar signals, and Wi-Fi module for transmission and LCD to for display. In each radar, the first processed signal is sent to the Raspberry Pi 2 module for secondary signal processing, resulting in the final counting result. The final counting result from the Raspberry Pi 2 is sent to the Wi-Fi module for transmission of the counting result.

VI. EXPERIMENTAL RESULTS

A sequence of UWB radar scans were measured using a time domain of 10 minutes at different scenarios. Here distance, time, speed of the person, direction of the person are taken into consideration in testing the project. Counting a Passing a person having normal speed of 5km/hr and at a distance of 30cm from the sensors. System detected a person passing through the IN gate with a speed of 5km/hr. Counting a passing person at high speed. System detected a person passing through the IN gate with a speed of 15km/hr. Counting a passing person at normal speed and at a distance of 60cms.

System did not detect a person passing through the IN gate with a speed of 5km/hr. Counting a passing person at normal speed and at a normal distance from both the ends. Here system had detected persons from different directions but the outcome of the test was always not correct.

Below are the images that was displayed on LCD.

Fig [2] Shows the LCD output

Fig [3] shows the website output

VII. CONCLUSION

The UWB radar-based human detector has better than 80% detection probability with 1.58% false alarm rate in a realistic outdoor environment. While we only tested the detector in conditions containing fixed objects, it is likely that the maximum magnitude, range spread, and velocity features may be useful for discriminating humans from common clutter, such as small animals and baggages, which might arise in a surveillance application. To improve detection performance, better segmentation techniques or feature aided tracking can be employed.

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