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INVENTORY MANAGEMENT

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Abstract: Our project aims to provide an advantage to the retailers by eliminating the need to check for supplies on a regular basis. This platform utilizes ultrasonic sensors to monitor the stock. The Ultrasonic sensor is configured to detect when the total quantity of one particular item in the shelf drops more than 50 percent of its total quantity. A notification is sent to the user's mobile phone via Bluetooth as and when the stock drops. This threshold can be changed according to the user's needs, which makes it even easier for the supply team to manage restocking. This can also be configured to keep the stocking of almost all products in a store. This improves the ability of the retailer to provide better customer experience since availability of the items that the user wishes to buy is vital to customer retention, which is all what a business needs.

Keywords: Internet of Things, Smart Shelf

I. INTRODUCTION

Inventory management is a concept which has seen a lot of technological advancements especially with the advancements of artificial intelligence and RF-ID technology. The quantity of products and their placement in a considerably large warehouse is very crucial in maintaining a warehouse with efficiency. By efficiency, we mean the relative ease with which products are stored, how many are still available in the warehouse, where in the warehouse are they stored and etc. Technological advancements have paved the way for cameras to be used coupled with artificial intelligence which can use image scanning to detect the type and quantity of products and can be programmed to notify the concerned personnel based on the requirements. Radio Frequency ID's can also be used where each product has a specific ID which can be scanned each time when the product is handled. This helps in distinguishing the type of products that are handled, but does little to ease the work done in calculating quantity. Cameras on the other hand, along with artificial intelligence are a very costly since for an effective camera that can scan a whole section of a warehouse or even a shelf, it costs tens of thousands of rupees and that is for the camera alone. The software costs the same or even more, for that matter and cannot be deemed consistent since artificial intelligence is in itself a developing branch of science, one that if not perfect. On the other hand, radio frequency ids though useful in distinguishing between types, actually make the entire process longer and tedious since each item has to be scanned properly.

This paper proposes a simple, yet cheap alternative to both the aforementioned technologies, in the form of an ultrasonic sensor. An ultrasonic sensor can be attached in a shelf, wherever deemed fit to calculate the quantity of items in a shelf. The ultrasonic sensor is very cheap and the code that is required to make this work is very simple and can be altered according to the dimensions of the shelf. The data is real time and notifications are sent to the user's mobile phone connected via Bluetooth.

II. ARCHITECTURE

A. Arduino Uno

The Arduino Uno is an open-source microcontroller board that is equipped with sets of both analog and digital pins that can be interfaced with various expansion boards, in our case the ultrasonic sensor and the Bluetooth sensor.

B. Ultrasonic Sensor: HC-SR04

The Ultrasonic sensor uses SONAR to determine the distance of an object, just like bats do. It offers excellent non-contact range detection with high accuracy and stable reading in an easy-to-use package from 2 cm to 400 cm. The operation is not affected by sunlight or black material, although acoustically, soft materials like cloth can be difficult to detect. It comes complete with ultrasonic transmitter and receiver module. It can be attached to the Arduino Uno without any complications.

C. Bluetooth Sensor: HC-05

The Bluetooth sensor is a module which is designed for wireless communication. This module can be used in a master or slave configuration. It has a range of up to 100 meters which depends on a multitude of factors that include atmosphere, geographic and urban conditions. It can also be attached with an Arduino Uno which in turn can be used to pair up with a mobile phone, to which the data can be sent.

D. Mobile Phone

A mobile phone is the perfect device for this situation since it is very compact and almost everybody has one today. Every Smartphone has Bluetooth facility enabled in it to facilitate wireless communication with other mobile devices, wireless headsets and other devices.

E. Bluetooth Terminal

The Bluetooth Terminal is an application in the mobile phone that enables the user to pair up with the Bluetooth

sensor that is connected to the Arduino Uno in order to transmit the data from the Ultrasonic sensor to the mobile phone in real time.

III. PROCESS

The entire process starts when the entire system in switched on. The ultrasonic sensor attached to the shelf (for this case, on the top, facing the ground) starts generating and transmitting data every second. The Ultrasonic sensor starts calculating the distance between the top of the shelf and the base of the shelf. The idea is very simple. The value of the distance should be less if there in sufficient stock. Let us take an example. If the length of the shelf is 10 meters and each product is exactly 1 meter in width. Then, 10 items can be stored in that particular shelf. When the shelf is fully stocked, the Ultrasonic sensor calculates the distance to be 0. This is because the ultrasonic wave that is emitted from the transmitter hits the product at the top of the shelf and reflects back to the receiver of the ultrasonic sensor. Each time a product is taken from that shelf, the distance between the sensor and the topmost product increases, thereby increasing the calculated distance by the sensor. For this example, we can also say that a notification pops us along with the data transmitted; urging the user to restock when the distance calculated reaches a certain threshold. Even if the user's phone is disconnected, the data transmission is not affected at all. The data is transmitted without any end receiver. It can still be seen in the output terminal of the existing system (Connected computer).

IV. ALGORITHM

1. The system is switched on.

2. The Ultrasonic sensor starts generating data

3. A mobile phone is connected to the Bluetooth sensor.

4. The Bluetooth sensor starts transmitting real time data generated from the Ultrasonic sensor to the mobile phone.

a. An additional notification is sent when the distance threshold is crossed.

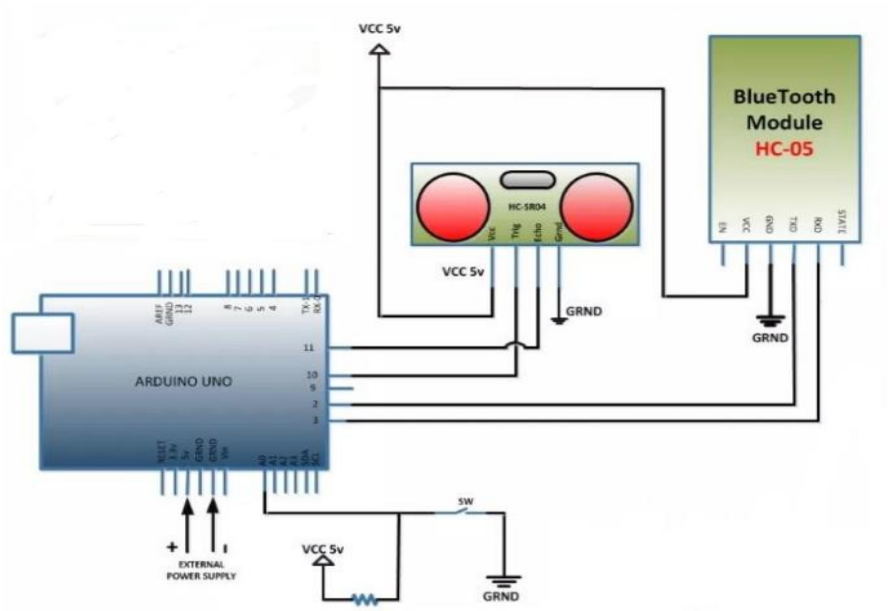

Figure 1: Architecture Diagram of the setup

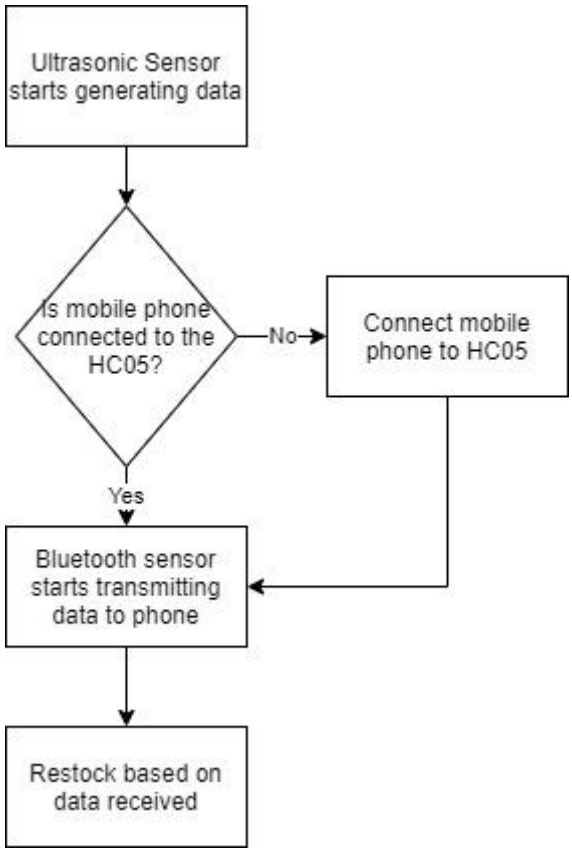

Figure 2: Flowchart of the intended setup and it's flow

The flowchart here indicates the order in which the entire system operates. The data generated from the ultrasonic sensor is transmitted irrespective of whether a mobile phone is connected or not.

V. EXPERIMENTAL RESULTS

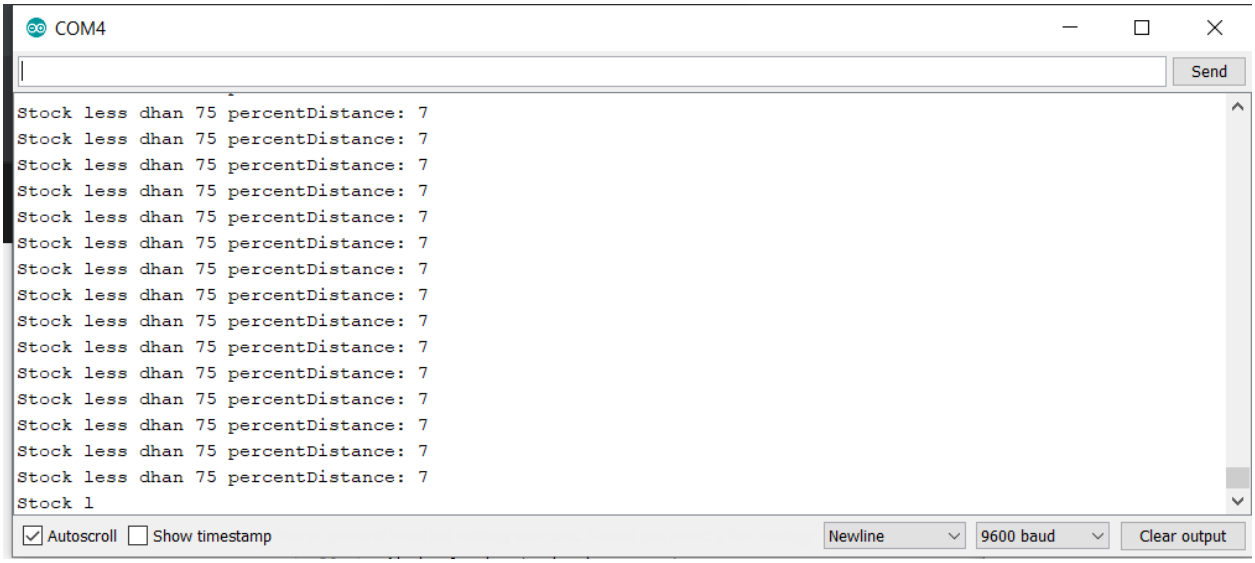

Figure 3: The Serial Output received from the Ultrasonic sensor based on the readings.

VI. FUTURE ENHANCEMENT

Although we are using a Bluetooth sensor for the time being, a Wi-Fi module could have the potential to replace it as a potential wireless communication method since Wi-Fi has more range, better communicative capabilities and faster transmission speeds. But unfortunately, a Wi-Fi module is not breadboard friendly and hence is not a viable alternative to the Bluetooth model now.

VII. CONCLUSION

In this paper, we can clearly realize the efficiency and the simplicity that the ultrasonic sensor brings to the table. The concept of being notified of the quantity of stock at the palm of your hand (mobile phone) is as efficient as inventory management can get. The fact that it is cheap, easy-to-use, small and compact makes it a perfect component to be used in inventory management. Given the situation we are all in, with respect to the **Novel Corona Virus**, we can be rest assured that warehouses would want to keep live track of their stock. Our proposed system here makes this process easier and is simple enough to be setup without requiring much work. This ultrasonic sensor is proposed with a belief that inventions need not be complex or intelligent; they just have to be simple with only one goal in mind, which is to ease the work of the user.

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