Building Automation Sensor Network

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8th June 2016

1. **Backgrounds**
   In this section, I will introduce some backgrounds and motivations of our work, which is an interdisciplinary project.

   (a) **BIM (Building Information Modeling)**
   Buildi ng information modeling (BIM) is a process involving the generation and management of digital representations of physical and functional characteristics of places. Building information models (BIMs) are files (often but not always in proprietary formats and containing proprietary data) which can be exchanged or networked to support decision-making about a place.
   Current BIM software is used by individuals, businesses and government agencies who plan, design, construct, operate and maintain diverse physical infrastructures, such as water, wastewater, electricity, gas, refuse and communication utilities, roads, bridges and ports, houses, apartments, schools and shops, offices, factories, warehouses and prisons.
   BIM is definitely a mature technique in software, nevertheless, *the building proces is far from a real automation system. For the process depends most on people, which is unsafe and inaccurate.*

   (b) **Building Blocks**
   Building Blocks are made advancedly to be assembled to the whole building. Just as we play with **Lego Bricks**. It is the elementary unit of the modern building process, saving a great amount of time.
   We focus on the 3-D position (including 3-D angles) of the building blocks, trying to get that information using sensor network.

2. **Current System**
   In this section I will birefly introduce our current system, which uses sensors and PC to get and process information.

   (a) **Sensors**
   Here we start from the very beginning in this field. We investigate many kind of sensors on their functions and applications. Such as *Lazer*, *Infrared*, *Ultrasonic*, *Angle* and *Acceleration* sensor. All these sensors have their own advantages and disadvantages as shown below:

      i. *Lazer* sensor have a perfect accracy, and a large measuring range. However, it highly requires an accurate direction, which is not suitable for our project where the object moves iregular. It is like in Fifure 1.

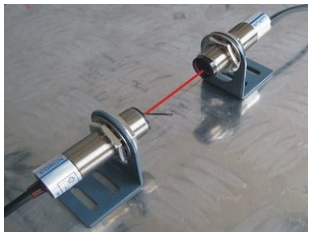

Figure 1: Lazer

ii. *Infrared* sensor have great accruacy, and a wode spread angle. However, using infrared for measuring diatance is limited for the measuring distance is limited. It is like in Fifure 2.

Figure 2: Infrared

iii. *Ultrasonic* sensor get middle accuracy, spread angle and measuring distance. It can get distance within 4 meters and have a 15-degree spread angle. That's why we choose it for the first system demo. It is like in Fifure 3.

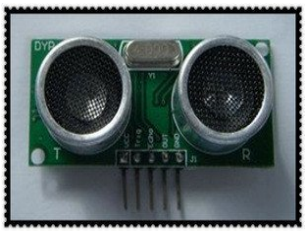

Figure 3: Ultrasonic

iv. *Acceleration* sensor provides information on $x-axisy-axis$ and $z-axis$, we can use $x-axis$ and $y-axis$ angle to make sure that the building block is horizontal. It is like in Fifure 4.

v. *Angle* sensor use earth magnetism to get the absolute angle of the building block's direction. It is like in Fifure 5.

And we finally build our system using 2 *Ultrasonic*, 1 *Acceleration* and 1 *Angle* sensor. The system can be shown in Fifure 6:

(b) **Communication**

The communication have a great importance on this system, for we have to get the information from the SCM to PC. Then we can process data in the PC to generate some control signals. The GUI of our system is shown below in Figure 7:

It shows all the required information from the sensord and we can give a simple guidance of the nexy operation just listed on the GUI screen.

Figure 4: Acceleration

Figure 5: Angle

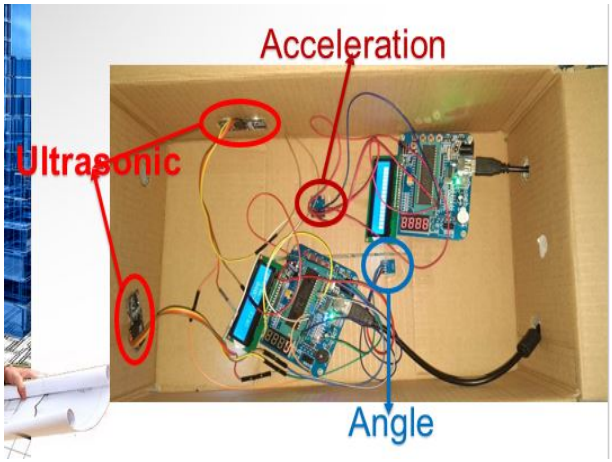

Figure 6: The final system

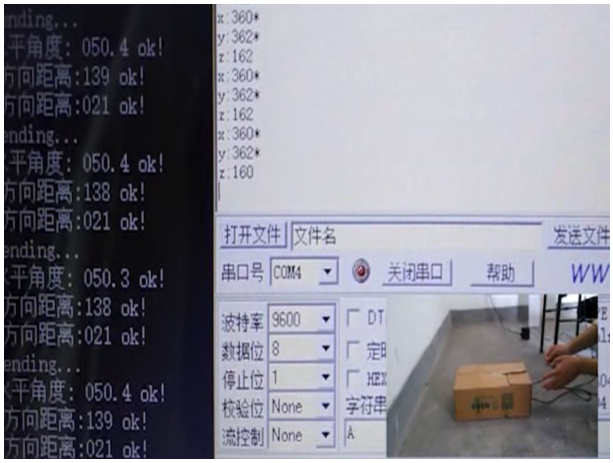

Figure 7: The GUI

3. **Future Work**
   Our future work is listed below:

   (a) Attach sensors to blocks

   (b) Use wireless communication

   (c) Handle the power supply

   (d) Test in construction site