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CloudBuggy Mobile Sensor Platform Development and Cloud Service Integration as an Internet of Things Demonstrator

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Abstract

One of the interesting research area of electrical engineering and information technologies is the field of mobile robots. However, building such robots is an expensive and complex task also involving very distinct fields of knowledge. Building such robot requires mechanical, electronic, low and high level software design and implementation, including artificial intelligence on the top of all, most cases a large number of developers are needed to conclude a successful project. Of course, such robots are available on the market, but their price and limited functionalities (most cases they are humanoid or try to mimic animals) are restrictive in large number of innovative project. Therefore, it is interesting to develop a low cost, non-humanoid (wheeled), flexible, extensible mobile robot based on commercial off-the-shelve (COTS) components using a low-cost, fast-prototyping approach.

Our paper will show the development of such robot, primarily a mobile sensor platform as it cannot interact with the environment but only sense it. The sensor platform is called CloudBuggy, as it is based on a 1/10 scale remote controlled buggy chassis. The steering, transmission and low level servos are used without modification from the original remote controlled buggy. A new low level hardware interface electronics (PCB) is developed to interface the servos to a Raspberry-PI single board computer. It provides isolated power source for the Raspberry-PI and sensors also as the power source of the car is very noisy for sensitive electronics as the servos may generate high electronic noise during operation. Currently, the system includes a forward looking high resolution image sensor (in the form of the Raspberry-PI camera), COTS accelerometer and gyroscope board. Currently, the buggy is to be extended with ultrasound rangefinders for more precise obstacle detection and with standard microphones and speaker for human voice communication. As the Raspberry-PI has limited processing resources, the buggy streams all sensed information into the Cloud (currently, the department's own PaaS infrastructure is used) using a WI-FI interface through the WI-FI network of the University. All actual information processing is done in the Cloud. We implemented a low delay communication approach for on-line control capabilities. The CloudBuggy also provides operational information about itself, such as battery status, CPU and memory load, and communication link utilization, etc.

Currently, our primary application is indoor navigation and WI-FI signal mapping, in which we use QR code based reference points (determined from the streamed video), and inertial navigation based on

accelerometers and gyroscopes. The WI-FI access point and signal strength information is acquired from the USB WI-FI interface of the system.

The final paper will show all fundamental design decisions and it will compare our approach to other similar systems. In addition, the paper will show how this mobile sensor platform is integrated into the IoT demonstrator system of the department making possible mobile observations in such systems and testing it in larger scale experiments.