New Stem City:

A Cyber-Physical Platform for STEM Education

(Work in progress)

This work-in-progress paper describes a new platform for supporting class work at all educational levels in STEM and computer science. New Stem City (NSC) is a physical table-top model of a town, complete with houses, a power plant, a model train, a working boat lock and even a helicopter. However, all of the components in NSC are wired with sensors and controls that feed into Raspberry Pi computers built into the modules and, from there, to a simple graphical human-machine interface (HMI). These systems use a simple protocol where all transmitted values are in plain, human-readable text, facilitating understanding for lower grade levels.

Since the primary target for NSC is minority schools that are often underfunded, the entire platform is designed to be low-cost and modular. This allows a school to build a single component, such as the power plant, for only a few hundred dollars. Construction of a module can also provide classroom activities as students can learn about simple wiring, microelectronics, networking protocols and mechanical engineering as they assemble the various parts into a working component. Component lists, building instructions, source code and sample lesson plans for NSC will be provided to educators at no cost.

Future work for the New Stem City platform involves deploying the platform to our partnering K-12 school district for use in physics, computer networking and other classes. The lesson plans generated from this partnering program are expected to be placed in a repository and shared with any interested schools. In addition, we are porting the HMI to an Android compatible app, which will allow students to control the components from their cell phone.