Iot space heater

761761Io-based IoT Smart Electric Heating Control System: Design and ImplementationIvan Ganchev1,2, Zhanlin Ji1,3,M'airt'ın O'Droma11Telecommunications Research Centre (TRC), University of Limerick, Ireland2Edition of Computer Systems, Plovdiv University Paisi Hilendarsky, Plovdiv, Bulgaria3North-China University of Science and Technology, Tangshan, China{Ivan.Ganchev; Jeanlin.Ji; Mairtin.ODroma}@ul.ieAbstract- This paper presents the design and implementation of an IoT-based smart electrical heating control system for homes, offices, schools, community centers, etc. The architecture provides a gateway to the IoT cloud for a data transfer (DTU) control system that sends ciesor data to the IoT center via a TCP server through the GPRS/Wi-Fi wireless interface and receives power telecommunications connections for dispatchers who thus turn off, turn on or configure the electrical heating system. Descriptions of the hardware and software are set out here from a small pilot system that has been successfully developed and implemented. Keywords — Internet of Things (IoT); Electric heating control system; Data transfer unit (DTU); Smart home; Hadoop.I. INTRODUCTIONChina is an example of a country where the government actively promotes the transition from burning coal to electric heating. The drive stemmed from significant air pollution by burning coal, especially air ash particles and sulfur dioxide pollution, [1]. The impact of pollution helps to understand the massive need to switch to electric heating, and hence the importance of planning for economies and efficiencies from the outset in this transition. In Beijing, incentives are good to make the switch, for example for homes or schools, the government covers the cost of electric heating and installation entirely [2]. In addition, the cost of tenerife for the user is only 0.1 yuan (0.0014 euros) perkilowatt-hour (kWh). The government's goal is to reduce the cost of the Quality Index (AQI) in Beijing to less than 100 in winter. In the west and around the world, making electric heating systems smarter is a permanent area of R&D. Intel and Re-alValue have developed smart electric thermal storage systems (SETS) [3, 4], as part of the 15.5M European Energystorage project, RealValue, funded by the EU's Horizon2020 research program. The field trial includes 800 smart thermal storage systems to be installed in Irish homes. Each of these systems will be fully controlled by the owner of the house, based on the timer. There is no Internet Theinges (IoT) dimension in this project. However, IoTenvironment has the potential to add value, and more flexible and intelligent solutions. This paper reports on the development of such a smart control system, operating as part of a central electric heating system, which is integrated into the overall ArchitectureIoT, conceived for smart cities. The developed system provides reasonable control over home/school and such based on the profiles of consumers, consumers, consumers, potential to exploit the economies mentioned above. The default heating setting can be stored in the supporting cloud, and be easily changed, or override with a convenient mobile application installedon consumers' mobile devices.II. The architecturea circuit system for IoT's smart electrical heating control system described here is shown in Figure 1, consisting of smart controls that include appropriate sensors, Data TransferUnits (DTUs) with TCP infrastructure support [6], and acloud platform.

1. Smart electrical heating control system Architecture.The key knowledge necessary for reasonable control in anylocation is the modern temperature and presence of people / appropriate activity in this place. There is enough temperature meter for them, such as the Maxim DS18B20 and people who havedector, such as the HC-SR501 infrared sensor, for example, to maintain control of a number of electric heaters with a specific area, such as four 1.5kW electric heaters within the 60-square-metre anschool class, which is 40st udents. Actual control can be using disabled relays/ or silicon managed acting (SCR) [7] . Controllers are ate with DTU. To do this, various solutions are possible, depending on the context; for example, wireless communication using nordicSemi nRF24L01P function is very integrated, ultrafig. 2. Hardware-low controller power (ULP) 2 Mbps RF transmitter IC for range 2.4GHzISM (industrial, scientific and medical) or Wi-Fitransceiver module, or wired, where possible, for example, with a RS /TIA-485 cable. In addition, DTU is equipped with inexpensive module General Packet Radio Service (GPRS) forcommunication with tcp-server and, through it, with a cloud. III. DESIGN AND IMPLEMENTATION. Smart controllerSound controller is the main unit in the electrical heating control system. An image of the typical configuration of the controller's hardware system for the 6kW heating system, consisting of an acquertic electric heater such as can be installed in the ora house class, is shown in Figure 2, and the principle of the diagram is shown in Figure 3. Each heater can be switched on/off with SLA-24VDC-SL relays. When switched on, the level of input voltage, and therefore the heating level, is controlled by SCR. By means of control directed by politicians, schedules or remote users, you canholy dedicate the heater as a smart one. As for finding an inexpensive design, this controller is based on 1 STMicroelectronics STM32F103 32-bit MCU, which has 48 pins, 128KB flash memory, 72MHzCPU, usb and CAN support. The software was developed with free real time System(FreeRTOS) . A brief summary of the software aspects is provided witha help, while the full detail of the key software components will be described in a later work.B. DTUDtu acts as a bridge between the Internet and the tecontroller. It has a GPRS module to communicate. 3. Example configuration of the hardware system controller. TCP servers in real time. STMicroelectronicsSTM32F103VCT6 was selected for this design. Pictures of DTU are shown in figure 4. It mainly includes a 3.5TFTtouchable screen, an RS-485 port, NordicSemi nRF24L01P, as well as Wi-Fi and GPRS wireless communication modules. The software running inside the DTU was developed using FreeRTOS. The system includes four tasks: (i) the USARTdata task, the main functions of which are SendRecvDataToDeal andComDataToSendGSM. The first function is used to process the resulting COMMAND data set, and the second function is used for transparent port transferRS485; (ii) Short MessagingService (SMS) tasks to control smart heater and update parameters by sending SMS; (iii) Network During last winter I began to prefer using infrared (IW) heaters (see figure). They can reheat a person or a specific area in a room that has to warm up the entire room, like A/C. Heating only part of the room saves a lot of energy, and it's also much faster than waiting for the whole room to warm up. The problem is that both IC heaters at my home have only 2 power levels. Without any control, it's easy to get there or too hot, or not a hot enough situation. Here I explain how I added reasonable temperature control, which also transmits Thingspeak.com data, because why not? The LCD shows the following: room temperature 24.56°C, error -1.43°C, which means the room is colder than the set point (rounded to 25°C). To equalize the temperature used heating power 100%. I'm acting that you already have a heating element. If it's not, check out this 9-inch Dish Heater.Parts list:Project options:WiFi functionality: it's really cool to control things in the Interner of Things (IOT) era, but not necessarily if you just want a stable temperature. You can use a cheaper Nano-compatible board that doesn't have built-in Wi-Fi but will keep the need for No 7 elements because it runs on 5V, which are needed to turn on relays. LCD screen: While all data is downloaded in Thingspeak.com, if you want a second debugging screen or if you want to see the temperature, then keep the LCD display. Otherwise, you can always mark the temperature value on the rotary potentiometer. Power supply: Since this is my computer desktop heater, I power the board USB port that is compatible with the computer. Diagram with Wi-Fi and (backlight off) runs on a 1600 mAh battery capacity for ~36 hours. So, apart from a USB port, I would recommend one of these 220V to 5V step down power supplies or a simpler Wall charger with a micro-USB cable to power the board. Connect micropansion Cactus and all the other parts as drawn here. WARNING: If you do not know high-voltage safety, DO NOT ATTEMPT to connect relays and heater. In that case, I would recommend something like this remote-controlled socket to switch the heater. For the first few times I would offer power boards from your computer so you can use DEBUG mode where the thumbnail is completely verbatic. Later, you can power the board from the 5V wall charger. It's not particularly effective or short. Project settings (Wi-Fi, LCD) are separated, so they could be easily removed. Links to the 16X2 LCD can be found here. The Wi-Fi commands used here are taken from here. One of the cool features of the IOT concept is that each sensor can now download data over the Internet. You can either submit data or wireless device control, or both actually ... I used thingspeak.com to help me understand how the heater ramps up, and how it responds to the point of change. Go to www.Thingspeak.com, sign up for your account. Configure the channel and copy the recording API key to the appropriate thumbnail location. Decide what data you want to download and change the array fields in the thumbnail respectively (about line 132) Back in your Thingspeak channel, go to Channel Settings, set the channel name and name the fields you will load. Make private or public data stories. Output power and PID error are important for the next step, which will adjust the temperature feedback settings. The goal of feedback is to keep the temperature stable at a certain point. Many thermostats use a proportional-integrater-derivative (PID) procedure for this purpose. The idea behind it is explained in this Youtube video. While an unconfig tweaked thermostat can be unstable (temperature fluctuations) if you don't customize the thing, my default settings (Kp, Ki and Kd in the thumbnail) can work for you, and all you have to do is choose the WindowSize option, which is the time span between arduino solutions to change the heating power. WindowSize should reflect the typical time it takes to change the temperature due to a change in heating power. Choose a large WindowSize if the temperature sensors are away from the insulation, or a small value otherwise. I have a heater and sensors placed on the same table ~ 30 cm apart, so I chose 4 second WindowSize.If you feel the need to configure PID settings for higher stability / faster time increase, you can find it Useful. The correct picture shows an example of a 9°C heating sequence where the heating power (orange line) is 100% for 9 minutes, then the temperature error, which is a shift away from the installation point, stabilizes beautifully (blue line) in the ±0.3°C range around the point. The main cause of instability is the A2D cactus, which can read temperature sensors at a resolution (3.3 V / 10 mV/°C)/1024 = resolution of 0.3 °C, which is simply perfectly edgy for home use. The left graph shows the differences between the LM35 and TMP36 sensors. I found the TMP36 sensor somewhat more stable and I recommend having more than one sensor as it adds some reliability to the device. Please add your comments and suggestions ;) ;)

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