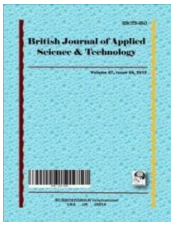

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Microcontroller Based Office Communication Model (MBOCM)

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Authors' contributions

This work was developed in collaboration by the both authors, who contributed equally to the literature review and writing of the manuscript. Both authors read and approved the final manuscript.

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ABSTRACT

Technology has brought convenience to office activities by integrating communication model into electronics device. This work focused on Microcontroller based office communication model for establishing end to end communication nudes primarily to achieve fast message delivery without the visitor consent. An Atmel microcontroller (AT89C52) was used to design and construct the device and administrative languages were coded in numeric codes using C programming language which was compiled on keil micro-vision compiler platform. Communication model was setup using duplex communication and the interfaced keypad was used to input visitor's request at lower officer front desk. The user (lower officer) will get quick response (Allow or Deny) from higher officer therefore, the lower officer will respond to visitor(s) using MBCOM message status. The results proved that the designed Microcontroller is efficient for running secured end to end communication broadcasted over LCD display. The performance is excellent in terms of timely response and also with respect to message delivery from both ends.

Keywords: Communication module; front desk; LCD display; microcontroller; visitor.

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1. INTRODUCTION

Office management is characterized using intercommunication protocol within colleagues (co-workers), higher officer to lower officer and as well as communication between secretary and Bose/boss therefore, process has regulated entry and exit of visitor especially during office hours. This research is used to create logistic notification system strictly from lower officer front desk. Since the administrative communication protocol can be strictly confidential for creating, sending and delivery message from visitor log therefore, response from the host will be precise using two basic functions for administrative response, i.e the appearance stage of visitor arrival or visitor request for visit and the host action based on acknowledgement and feedback [1].

The crucial role of the secretary in the disseminations of information is useful evidence that requires improvement on the performance of intercommunication protocol and the quality of results that they return. However, the conventional approaches of using an intercom have limitations and shortcomings especially regarding the confidentiality of the information between the visitor and the secretary [2]. Therefore, we believe that the exploitation of contextual elements of a microcontroller could be a very good way to improve a communication unit of lower officer. So, this paper aims to build an automated system that will alert an office Boss from the Secretary's table that a visitor has arrived.

In many instance, visitors to large apartment complexes are typically screened by a security guard and secretary in the lobby before being allowed to enter host office. Over time, secretary and guards/ receptionist are able to immediately notify the visitor's host of the guest's arrival over the building intercom system. This communi-cation system could function well at the reception unit with an interactive solution to present visitors with a friendly and functional means to interact with employees for effective service delivery in the organization [3].

MBOCM is implemented as a collection of agents in a multi-agent system for several aims [4]. First, the components require module platforms: for instance, the keypad interface is limited to typing text messages at both ends, while the LCD module displays attribute to output system. Similarly, MBOCM functions can reduced excess workload therefore, it can be use to determine when to and when not to receive visitors. For instance, instant communication can be established when visitor arrives without visitors' awareness and host (higher officer) response or message status will be logistically follow by lower officer in the same office.

In this paper, a protocol device for inter-communication between secretary and boss is presented. The system uses Microcontroller based rules for enhancing conventional approaches of using an intercom.

The remaining of the paper is organised as follows: Section 2 describes the requirements for microcontroller based office visitor Communication system. Design issues of such a system are discussed in section 3. In section 4, the representation administrative languages are presented. Finally, the paper ends with a conclusion and future works [5].

Researchers are conducting series of researches and series of technologies are being deploy into global market on office management (like access control system, visitor alert system, biometric access mode, auto tracking system, visitor work flow system etc) but most of these technologies focuses on generic environmental problems and as such their adoption were not secured in most developing countries. The invention and design of MBOCM was deduced from office visitation logistic that required scalable design in order to be adaptive to every office environments [6].

2. THE MICROCONTROLLER BASED OFFICE COMMUNICATION MODEL (MBOCM)

2.1 Device Framework

MBOCM Model framework is an evolutionary interface modules that render full duplex communication using microcontroller device this will be described in precise using block form.

2.2 An Overview of MBOCM Components

The inter-officer communications in the MBOCM framework is performed using a module known as a keypad: Essentially a small 4x3 dot matrix - contained interlace flex that generate pause signal. This is required at lower officer desk to communicate higher officer using administrative

codes, containing named visitor request that can be read, added or removed. Fig. 1 is a model used when sending requested services as coded in form of message from lower officer to higher officer. This microcontroller module has bi-directional interface that communicates through I/O ports under programmed and it is used to control other interface modules (LCD and Keypad). Fig. 1 indicates internal configuration using additional variables (administrative message codes) which made it suitable in different organizations to manage visitors flow. Keypad enable the user (secretary or lower cadre officer) to send undercover static message over wired MBOCM device made output details available on LCD [7,8].

This framework concentrates on` general end to end aspects of communication model, for instance, visitor services can easily be executed in close network, and can be invoked either synchronously (function call semantics) or asynchronously (message semantics). The framework was designed using two ends (Lower officer and Higher officer) communication wired technology which provide transparent support for secure interactions between lower officer and higher officer in same organization, lower officer use public-keypad authentication and create a fast symmetric session-key for further communications to higher officer based on visitor request by identifying visitor purpose of visit [9].

The communication network comprises of boxes representing modules that form MBOCM device. The heavier lines show the major close loop of data pathways and the light lines show communication path. A line with double arrows represents a synchronous data exchange while one with a single arrow indicates asynchronous data flow path. (See the text for details in methodology) Instead, MBOCM Model enables rapid development of communities where the officer interactions can be modeled as service requests. Additionally, MBOCM provides a novel, cross-office generalization of pipes [10,11]. This section presents an overview of the MBOCM model architecture (see Fig. 2) and details the important officers and their interactions. In MBOCM architecture, three tasks may be summarized as:

1. visitor identification in the lobby and notification request from lower to higher officer desk
2. under covered message transmission by lower officer unknown to visitors;
3. Response on visitor request from higher to lower officer desk

Since these tasks occur in parallel way, lower officer perform several roles simultaneously. In the primary duties, must identify visitor, and send visitor request over MBOCM device. In the event of a positive response from higher officer to grant visitor request, the lower officer will respond to visitor based on notification on MBOCM device message status grant.

In the other way round, a negative response from higher officer to denied visitor request, the lower officer will respond to visitor based on notification over MBOCM LCD status Denied [11].

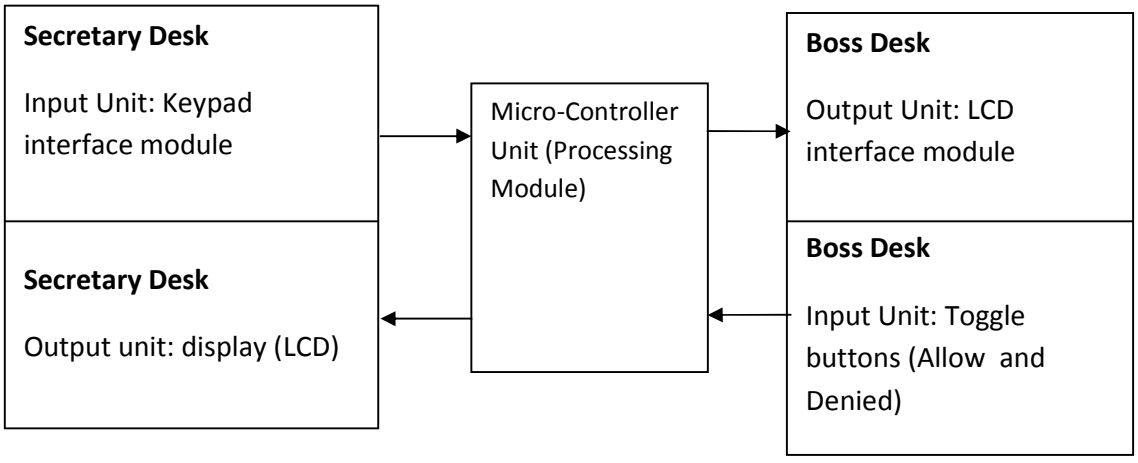

Fig. 1. An overview of the internals of a MBOCM model

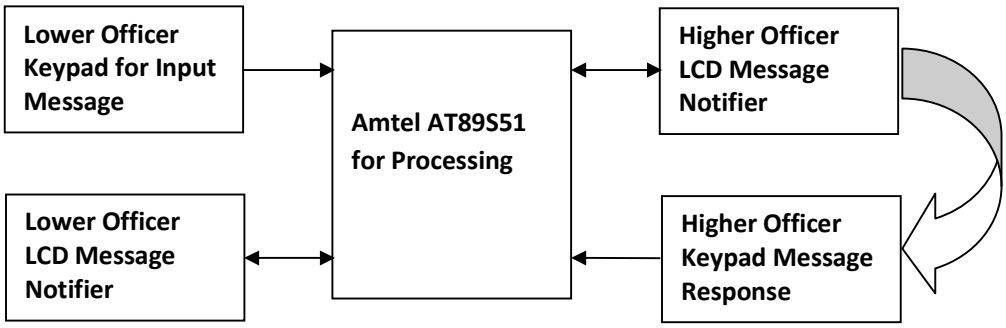

Fig. 2. This diagram shows an overview of the MBOCM architecture

3. PROCESSING MODULE

MBOCM processing unit receives administrative coded message via keypad and translated/s it to machined language (see details in Table 1) display via LCD therefore AT89C52 was used to integrate all input / output modules for end to end communication.

3.1 The Serial Ports Interrupt

AT89C52 will receive 'R' data byte then a bit will be set to 1 in the SCON register and on request; if to transmit data type 'X' then X will be witted therefore, interrupt will be set in SCON. The external as INT 1 are used by external CKT and it can be configured to either X' mission actionist or the external depending upon value at the units [12,13].

3.2 MBOCM Cycle and Crystal Frequency

The AT89C52 used in the design has an on-chip oscillator and also requires an external clock to run it. Most case a **quartz crystal oscillator** is connected to inputs XTAL1 (pin 19) and XTAL2 (pin 18). The quartz crystal oscillator connected to XTAL1 and XTAL2 also needs two capacitors of 33 pF value **interface**, the one side of each capacitor is connected to the ground [13].

To determined BMONS cycle for compatible chips as follow. If XTAL = 11.0592MGZ
For (a) AT89C52 :- 1/11.05952MGZ = 90.42 nanoseconds (ns)
Therefore MBOCM cycle = 12 X 90.42 ns = 1.085US
1 X 90.42ns = 90.42ns
4 x 90.42ns = 361.68ns

It must be noted for this design about various speeds of the 8051 family. Speed refers to the maximum oscillator frequency connected to XTAL. For instance, a 12-MHz chip must be connected to a crystal with 12 MHz frequency or less. Likewise, a 20-MHz microcontroller requires a crystal frequency of no more than 20 MHz to function well. When the 8051 is connected to a crystal oscillator and is powered up, the frequency from the pin XTAL2 was clearly observed over oscilloscope. For this reason the experiment deduced that "almost" is that the number of machine cycles takes to execute an instruction is not the same for the AT89C52 and DS89C4xO chips as narrated [14,15].

3.3 MBOCM Interface LCD Duplex Data Link

The LCD (Liquid Crystal Display) can deliver much information that single LED (Light Emitting Diode). LCD as a display device, that efficiently deliver characters format on screen is noted in the application of LCD types inline with design standard (IEEE) because its range in size, price and configuration, according to user applications. The recommended type for this design can display two (2) lines of characters with 20 character length. This provide fast communication link between microcontroller and the LCD module.

3.4 MBOCM Programmer Mode

The project cannot give expected output without been programmed, to achieved experimental aims. The program identify common administrate languages as user defined variables which can be modified or added via keypad service codes and compiling is done using keil micro vision software from high level programming (C source code) to machine language, therefore give output file (hex file) from compiled source code. The unipro universal programmer device is used to burn output file into microcontroller buffer.

3.5 MBOCM Keypad Data link

Keypad used for the design is an array of 4x4 keys with each key work like a switch [15]. Each keys combination represents administrative coded messages as used during programming. As a matter of fact, the key layer formed rows and are connected to pins 0-3 of **Port1** and the four columns to pins 4-7 of **Port1** as shown in the Fig. 6 below. The switching depends on logistic reading of a particular key with corresponding row and column driven to ports on microcontroller. If a key is pressed then microcontroller will detect corresponded coded message from the keypad. The same algorithms is used for other **ports** (2,3,4,5,6,7 & 8 respectively) for processing coded the messages, therefore high or low signal is corresponded to signal enable /disable (0 and 1) [16].

The MBOCM used numeric features of keypad as coded administrative communication such as 01, 02, 03 respectively for microcontroller to detect and transmit corresponding coded messages and when a key is press once, and then it will send request code to microprocessor. In Fig. 3, when user press a key twice, then it will systematically cancelled the operation (stop sending), this enable the user (lower officer) to send coded message with in a faster rate without interrupting other official activities.

The device will prompt user (lower officer) to input request, since all administrative messages are coded with numeric combination keys, the LCD display readable text on screen for equivalent numeric input as an expected output for both ends (lower officer and higher officer) as shown in Fig. 4.

Table 1. Shown the correspondent administrative codes messages in 4x4 interface duplex communications

SN	Administrative messages	Keypad keys
1	Examinations matter	01
2	Admission matter	02
3	Memo matter	03
4	Family matter	04
5	Official matter	05
6	Emergency	06
7	Staff	07
8	Student project matter	08
9	Research matter	09
10	Meeting schedule	00

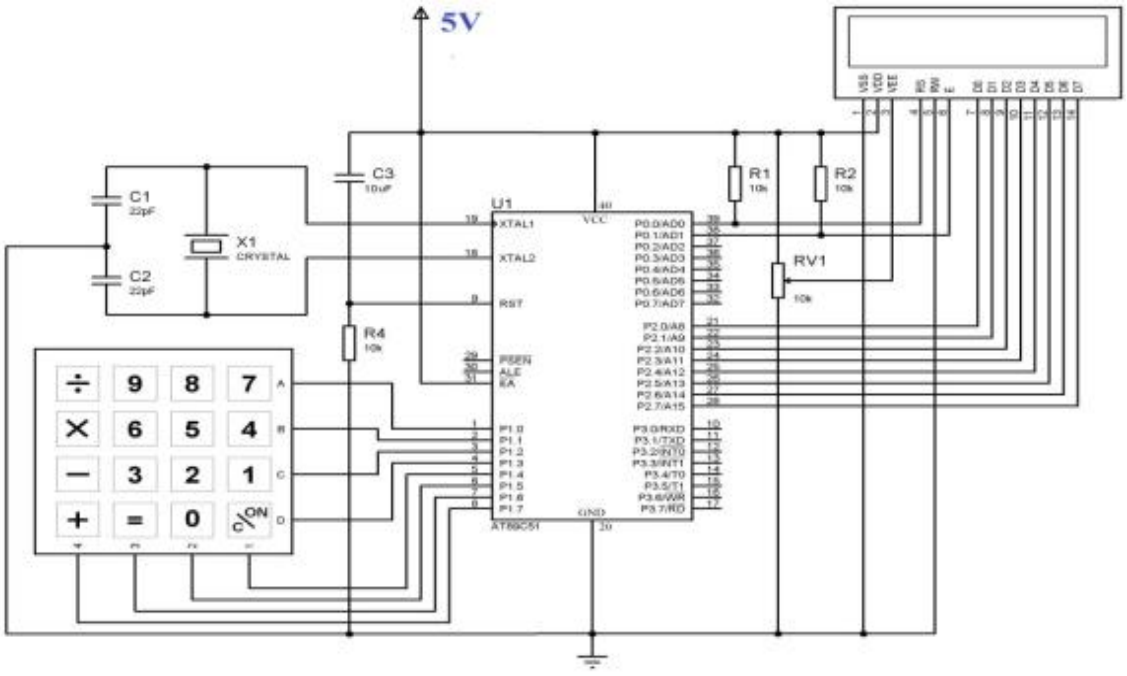

Fig. 3. Interface data link of keypad and LCD communication duplex

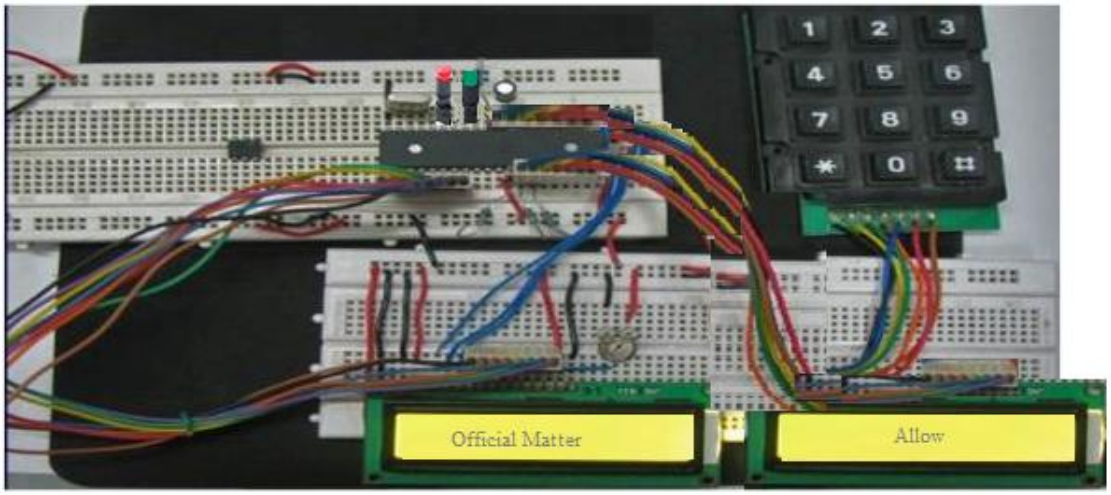

Fig. 4. Interface data link of keypad and LCD communication duplex

When a keypad is press by user, the microcontroller will spend few microseconds to process through 4x4 keypads with high response signal over interface keypad module. The Table 1 shows the administrative messages with corresponding codes and this can be modified internally using reprogrammable device. In the design, external modification can be done using console application written in C language to provide flexibility usage of MBOCM and scalability with respect to its organizational structure.

The interface links shown on Fig. 5 indicates relationship between microcontroller, keypad module, power unit and two interfaced LCD using port P_0, P_2, P_3 respectively. P_2 was assigned to Keypad, P_3 assigned to LCD_1, and P_0 assigned to LCD_2 respectively.

3.6 Experiments in Visitor Notification

This section summarizes three experiments that evaluate MBOCM dynamic functions using visitor request for service. The experiments reported here used data collected by MBOCM between 15th May 2014 and September 2014. Testing was done as the visitors approached the front desk from the interior of the building. The extracted request for each visitor varies using a physical contact with lower officer. Lower officer in his or her administrative role used the MBOCM to place visitor requests with no bias reason in order to evaluate efficiency of communication network without exposing MBOCM device access level to visitor.

3.7 Robustness Tests

MBOCM was subjected for 3 months lab testing in order to prove its adoption to office environment and had achieved 70% success rate. To increase efficiency, we have eliminated the synthesized bulky message from the keypad [16] and the current system is quite responsive with the use of 12 MHZ crystal. The Communication typically displays a message within a minute of a visitor's arrival therefore experimentation observation is accuracy for common visitors (colleagues at work and regular visitors with little description). The encoded administrative language was 100% accurate on LCD display. For the full case/ detail and over all evaluation, when dealing with visitor's with full description, the observed accuracy was 65% as regards secretary typing speed.

This strengthens the hypothesis that MBOCM device simple view-based nearest-neighbor classification scheme may be more robust than anticipated [17].

3.8 Security Policies

The MBOCM allow accurate and consistent administrative request application of security policies. The MBOCM application classified visitors based on the host (higher officer) pre-authorized and denied visitors priority. The MBOCM also check each visitor against his/her primary request. The (higher officer) host has the final judgement on request send by the lower officer [17,18].

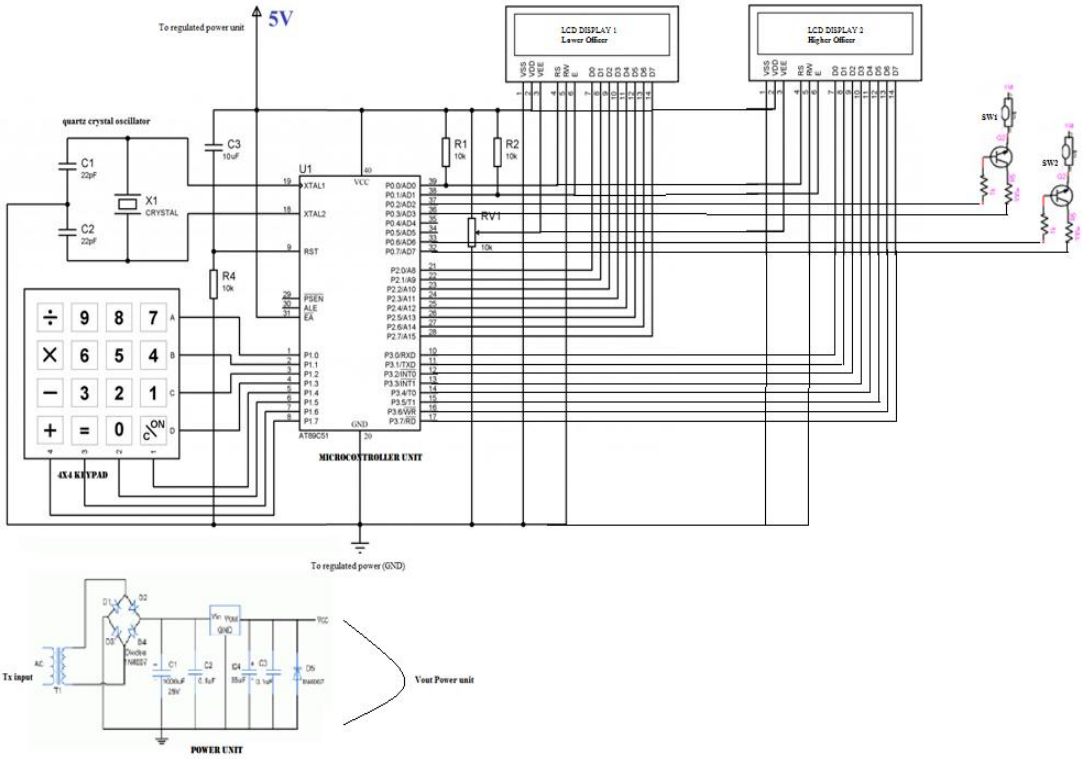

Fig. 5. Main circuit for MBOCM system

3.9 MBOCM for Host Management

The MBOCM users have full controls over MBOCM in terms of usage for the visitors and or communication mode required for staff of the organisation. The MBOCM users can differentiate visitors and staff of the organisation. Therefore, visitors can be controlled or limited by using MBOCM in the two offices (lower and higher) on daily basis [18,19].

4. DISCUSSION

Although MBOCM device achieves excellent results on the standard notification system, its performance shows that there is clearly room for improvement. Strategies for improving accuracy can be divided into two classes: Higher-quality input data on visitors' profile; and image capture for visitor's future references. Accurate and concise data was used in this research to allow transparency and improve response rate by using short code as administrative languages.

Looking at consistent for classifying visitation request, visitor request code is used to sent message successfully and receive accurate response from higher officer. Either of these schemes offers potential for officer customization. The MBOCM does not required additional software installation that will complicate the usage therefore, it capable of good intercommunication of both ends with distance range 100 to 500 meter apart using serial cabling method. We have also experimented with several variants of visitor request that show real time performance on this task. These include: (1) better preprocessing of input visitor request to compensate for lighting conditions; (2) simple feature extraction using c programming via keil micro vision; and (3) incorporating short code for interchange information using interface module. The MBOCM device architecture enables us to evaluate several notification algorithms in parallel multi-stage and we are upgrading the visitor requests from the internal and external interface port using technical support functions.

5. CONCLUSIONS AND FUTURE WORK

MBOCM device solves a real-world application by combining request and response for processing, machine language and messaging

channel in an end to end communication protocol. However there is still work to be done: The emphasis on packaging (casing) of this design is a major challenges while we have evaluated future improvement on the visitor (s) profile components for MBOCM, integrating wireless connection for easy installation. We plan to get a better idea of the over- all system's performance by getting feedback from a larger population of users to reliability. Since it is collecting a large dataset of labeled visitors, with multiple requests taken over a period of time, MBOCM future development will enables us to easily test different visitor(s) request in real-time in our local environment.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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